REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this gathering and maintaining the data needed, and completing and reviewing the collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson collection of information, including suggestions for reducing this burden. Dec. 2016.

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| 1. AGENCY USE ONLY (Leave blank) | 2. REPORT DATE 07/16/82 | 3. REPORT TYPE AND | DATES (| COVERED |
| 4. TITLE AND SUBTITLE ANALYSIS, NOR ROCKY MOUNTAIN ARSENAL, COMMERCE 6. AUTHOR(S) | | T/TREATMENT SYSTEM, | 5. FUND | ING NUMBERS |
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| STEARNS-ROGER ENGINEERING CORPO DENVER, CO | RATION | | KEPOI | NI NUMBER |
| | | | 8 | 8273R02 |
| 9. SPONSORING/MONITORING AGENC | Y NAME(S) AND ADDRESS(ES | 1995 | | ISORING/MONITORING ICY REPORT NUMBER |
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SECURITY CLASSIFICATION

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17. SECURITY CLASSIFICATION

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CONCEPTUAL DESIGN ANALYSIS
NORTHWEST BOUNDARY CONTAINMENT/
TREATMENT SYSTEM
ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO
FY 82 MCA LINE ITEM 37
DACA 45-82-C-0064

VOLUME II

Prepared By
STEARNS-ROGER SERVICES INC.
4500 Cherry Creek Drive
P.O. Box 5888
Denver, Colorado
80217

Project No. C-26616

16 July 1982

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VOLUME II

SECTION 1 - COST ESTIMATE BACKUP

SECTION 2 - DESIGN CALCULATIONS

CRAFT WAGE RATES (Denver Area)

| TRADE | Rate Per Hr. | Health & Welfare | Pension | Vacation | App. Train. | Other | Average PT&I | Total Per Hr. |
|----------------------------|-----------------|------------------|---------|----------|----------------|--------------------|-----------------|------------------|
| Carpenters | 14.87 | 1.20 | .85 | 1.00 | .11 | | 3.56 | 21.59 |
| Electricians | 17.85 | .34 | 1.25 | | .06(2) | .58 ⁽¹⁾ | 3.96 | 24.04 |
| Pipe Fitters/ Plumbers | 16.82 | 1.00 | 1.50 | 1.00 | .08 | | 4.02 | 24.42 |
| Laborer | 10.23 | 1.04 | .70 | .75 | .10 | .05(3) | 2.54 | 15.41 |
| Operating Engrs Group 5 | 13.90 | 1.19 | 1.20 | .60 | .12 | .05(4) | 3.36 | 20.42 |
| Millwrights | 16.76 | 1.20 | 1.00 | | •29 | | 3.80 | 23.05 |
| Ironworkers | 16.55 | 1.19 | 1.35 | | . 17 | | 3.80 | 23.06 |
| Cement Masons | 15.69 | 1.04 | 1.35 | | .13 | .05(4) | 3.60 | 21.86 |
| Painter | 15.61 | .91 | 1.15 | | .08 | 1.42(5) | 3.79 | 23.00 |

Notes:

PTI Average For Denver Area For The Above Crafts = 19.72018%

NEBF = 3% of Gross. Apprentice Training = 0.03% of Gross. Industry Promotion. Construction Advancement Program. Estimated Increase for 1982 - 8%.

| NW BOUNDARY CONTAINMENT FREATHENT CODE & (No design completed) CODE & (Preliminary design) CODE & (Final design) CODE C (Final design) OTHER (Specify) | CONSTRUCTION COST | DATE PREPARED | | | | 1002 | | | |
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| MECHANICAL | | | | | | | 97740 |
| SUB/CONT-OVERHEAD 20% | | | | | | | 19948 |
| SUB/CONT-PROFIT-10% | | | | | | | 11729 |
| SIG TOTAL | | | | | | | 129016 |
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| GIC. OVERHEAD- 10% | | | | | | | 12901 |
| G/U PROFIT - 5% | | | | | | | 1096 |
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| TOTAL D | | | | | | | 149013 |
| 10170 | | | | | | | |
| EVECTRICAL | | | | | | | 35447 |
| SUB/CONT OVERHEAD 16% | | 1 | | | | | 5951 |
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| 5/6 TOTAL A | | | | | | | 45538 |
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| G/C O'ERHELD - 10% | | | | | | | 4554 |
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| SIC PROFIT 10% | | | | | | | | |
| 5/C - TOTAL | | | | | | | | 313 |
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| TOTAL D | | | | | | | | 431 |
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| 90 PROFIT 10% | | | | | | | | 382 |
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| SIC OVERHEAD 20% | | | | | | | | 561 | |
| SIC PROFIT 10% | | | | | | | | 336 | |
| SIC TOTAL | | | | | | | - | 3700 | |
| GIC OVERHEAD 10% | | 1 | | | | | | 370 | |
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| DRAWING NO. | | ESTIM | | | | CHECKED BY | |
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| PONALES | QUANT | | | LABOR | | MATERIAL | TOTAL |
| PROCESS SUMMARY | NO. ETINU | UNIT MEAS. | UNIT | TOTAL | PER | TOTAL # | COST |
| PROCESS EQUIPMENT | | | | | | | * |
| RAW WATER FEED PUMPS | 4 | EA | 32 | \$3,126 | 5,332 | \$21,328 | ² 24,454 |
| RAW WATER PREFILTERS | 6 | EA | 16 | ± 2,344 | 4,780 | \$28.630 | ¥31,024 |
| ADSORPTION SYSTEM EQUIP. | 3 | EA | 136 | ±9,964 | _ | £38,000 | ±647,964 |
| BOOSTER PUMP | / | EA | 32 | ¥ 78 I | _ | ≠ z,800 | ± 3,581 |
| POST FILTEIL | 1 | EA | 32 | <i>\$181</i> | _ | \$70,133 | \$70,914 |
| AIR COMPRESSOR | / | EA | 36 | \$579 | _ | \$2,300 | ≠3,679° |
| TOTALS | | | | 17,875 | | 763.741 | 781.616 |
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| GC OVERHEAD 10% | | | | | | | 78.161 |
| GC PROFIT 5% | İ | | | | | | 42,988 |
| | | | 1 | | | | |
| TOTAL | | | | | - | | 902,765 |
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| PROJECT | | | | | BASIS FOR ESTIMATE | | | | | |
| N.W.BOUNDARY GROUP | 4D WA | TEIZ | CONTI | rol system | | | | | | |
| ROCKY MOUNTAIN AR | SENAL | ۵-ـ | MME | RCE CITY, CO | CODE B (Preliminary deeign) | | | | | |
| ARCHITECT ENGINEER | | | | | OTHER (Specify) | | | | | |
| STEARNS ROGER | | ESTIM | ATOR | 26616 | | | | | | |
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| 7 0011, 500 201 | QUANT | ITY | | LABOR | , | MATERIA | NL . | TOTAL | | |
| ARCHITECT URAL SUMMARY | NO. UNITS | UNIT MEAS. | PER | TOTAL | PER | то | TAL | COST | | |
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| | | | | | | | | | | |
| TCILET ROOM | 100 | SF | 2186 | 1 - 4, - | \$1:004 | 5 | - 05 | + | | |
| · 6 Reinforced block | 225 | HR | 21.00/HR | * 546.50 | \$1:00/SF | 120 | 0,00 | \$ 666.50 | | |
| wall 1415 x8:H-3074cloor | | ļ | | | | | | | | |
| | | | | | \$1057 | | | | | |
| · Door 287° | 3 | eq HR Set | 21.59 AR | \$ 64.77 | \$105/ | 310 | 500 | \$ 169.77 | | |
| · Door hardware | | HR | 21.59 | * 21.59 | Silo/ | 41 | 10,00 | 9 131.59 | | |
| | | | | | 1 | | | | | |
| ·Lauatory | -33 | ea HR | 24 A 2 | [‡] 73.26 | \$125, | 317 | 25.00 | \$ 98.26 | | |
| - | | | 7.515 | | 1 | | | | | |
| · Soap Dispenser | .5 | 254 | 21.59/42 | \$10.80 | \$ 24/es | \$2 | 4.00 | 3 34.80 | | |
| Sup Dispenser | . 5 | HP | / 1418 | | | | | | | |
| ·Mirror | | 84 | 21.59 | £ 10.80 | 346/ eq | \$44 | . 00 | *56.80 | | |
| · 10/17-07 | -5 | HR | HR | 10,80 | /eq | 44 | 2. | 70.00 | | |
| Tailat Dan Da | | Ea Ea | 21.59/45 | Fina | \$14/eq | \$1.4 | ,,00 | 24.80 | | |
| · Toilet Paper Dispenser | .5 | HR | -11/45 | F10.80 | 11/69 | 14 | ,,,,, | 27.00 | | |
| 0 + 15 | [| ea | 21.59 | 3120- | \$ 25/ca | 30 | 5,∞ | 35.80 | | |
| · Paper Towel Dispenser | ,5 | HR | AH R | 10.80 | /ea | , 2 | 5.00 | 15.00 | | |
| | | 100 | 15.41 . | * | \$157 | \$ | | * | | |
| Trash Container | .'5 | HR BB | 15.41 HR | \$7.70 | \$15/09 | \$15 | ,00 | \$22.70 | | |
| | | ea | 24.40 | + | 215 | | | 7 | | |
| Drinking Fountain | 2 | HR | 24.42 HR | *48.84 | 265/64 | *24 | 5.00 | 313.84 | | |
| F F.\// 10 | 1 | eq HR | 24.42 HR | [≠] 48.84 | 335/29 | \$2. | 35.00 | 383.84 | | |
| EMERS. EYEWASH & SHOWER | 2 | HR | \H₽ | 40.04 | 129 | | | | | |
| sub-total | | | | 854.70 | - | 7118 | 4,00 | 2038.70 | | |
| + Subcontract | | - | | | - | | | | | |
| TOTAL | | | 1 | | | | | 766,338.7 | | |

| CONSTRUCTION COST | | DATE PREPARED | | | SHEET | 2 of | 4 | | | |
|---|--------------|---------------|--------------|--------------------|------------------------------|--------------|-------------|--------------|---------------|--|
| PROJECT | | | | | BASIS FO | R ESTIM | ATE | | | |
| N.W. BOUNDARY GROUND W | JATEIZ | CONT | rou | system | - | CODE A | (No desig | n complete | rd) | |
| LOCATION ROCKY MOUNTAIN ARSEN | ΙΔΙ | ~romr | nerec | E CITY LO | CODE & (Preliminary deelign) | | | | | |
| ARCHITECT ENGINEER | <u> </u> | | | <u> </u> | | | | | | |
| STEARNS - ROBER | | | | | | | | | | |
| DRAWING NO. | | ESTIM | ATOR TEVE | V.W. | | CHECKE | DBY | | | |
| | QUANT | | | LABOR | | ATERIA | L | - | OTAL | |
| ARCHITECTURAL SUMMARY | NO. UNITS | UNIT MEAS. | PER | TOTAL | PER | то | TAL | | OST | |
| Painting | | | | | | | | | | |
| · Block wall | 240 | SF | 23.00 UR | + 138.00 | 14/5F | * 33 | 3.60 | ±17 | 1.60 | |
| · BICER WAII | | | | | | | | | | |
| · Doors 4 doors x 2 sides | 8 | HR | 23.00) UR | \$ 92.00 | 2.10 | \$ 17 | 1.28 | 10 | 9.28 | |
| TOOL 3 GUODES x ESIGES | 4 | 172 | . 1016 | | - 31 | | | | | |
| ·PLywood 505F+2 | 1.00 | SF HR | 23.00 HR | \$ 92.00 | .16/SF | \$ 10 | 00 | 10 | 8.00 | |
| ·PLywood 505f+2 | 4 | HE | /HK | 7555 | - 3 | 10 | | | | |
| 1 | 50 | SF | 21.59 | ₹43.18 | 71/SF | ±35, | 50 | 7 | 8.68 | |
| Metal studs 6'22'o.c. | 2 | HR | HR | 45.16 | 125 | 32, | 30 | | 0.00 | |
| | | 129 | 23.00 | 500 01 | 5.00 | f 5 | | | | |
| Clip angle 13×3×1/4 | | 64 H15 | 23.00 FIR | | lea | 1. 5 | ,00 | 7.8 | 8.06 | |
| | 2 | Shits | 21.59 HR | * | 25/ | \$- | | | 2.10 | |
| Phywood decking 34.0 | 3 | HR | HR | [‡] 43.18 | 25/snt | ₹5c | 0,00 | 9 | 3.18 | |
| | | & HT4 | 21.59 | | 23. | 4 . | | | 2 12 | |
| Plywood ceiling 12"A.C. | 2 | HE | 21.59 HR | P43.18 | 23/SHT | \$46 | ,00 | 8 | 9.18 | |
| | 50 | 5.5 | 01.59 | | 7(3 | 3 | | | | |
| 6" Both Fiberglass Ins. | 1 | HR | 21.59 HR | 21.59 | 1.29 /SF | 10 | ,00 | 3 | 1.59 | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| TOTAL | | | | 496.19 | | 321 | 3.38 | 770 | 9.57 | |
| | | | | | | | | | | |
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| | | + | <u> </u> | | | | | 1 | | |
| | | + | | | + | 1 | | † | | |
| | | +- | | | + | | | 1 | | |
| ENG FORM | <u> </u> | | | | | * 2 2 4 | TERMENT PEN | ITING OFFICE | 1959 0-516148 | |

| CONSTRUCTION COST | STIMA | ΓE | | DATE PREPARED | 3 0 4 | | | | | |
|-----------------------------------|--------------|---------------|----------------------|---------------|-----------------------------|------------|---------------------|--|--|--|
| PROJECT N.W. BOUNDARY GROUND | WATE | 2 6 | ontie: | ol system | | R ESTIMATE | | | | |
| LOCATION ROCKY MUUNTAIN ARSEN | | | | | CODE B (Preliminary design) | | | | | |
| ARCHITECT ENGINEER STEARNS-ROGEIZ | | | | | CODE C (Final design) | | | | | |
| DRAWING NO. | | ESTIM | ATOR TEUE | V. W. | CHECKED BY | | | | | |
| | QUANT | | | LABOR | | AATERIAL | | | | |
| ARCHITET, URAL SUMMARY | NO. UNITS | UNIT MEAS. | PER | TOTAL | PER | TOTAL | COST | | | |
| Sewage Disposal | | 20 | 2- 42 | | 220 | • | | | | |
| · Septic Tank-500gal | 4 | HR | 20,42 HR | 81.48 | 220/29 | \$ 220.00 | ¥301.68 | | | |
| excavation | 2 | HR | 20.42 HR | 40.84 | | | 40.84 | | | |
| backfill | 2 | HR | 20.43 HR | 40.84 | | | 40.84 | | | |
| | | | 20.42 | | 2.05 | | | | | |
| · Dosing Tank | 4 | HR | 20.42 /HR | 81.68 | 200/64 | *200.00 | \$281.68 | | | |
| excauation | 2 | HR | 20.42 HR | 40 84 | _ | | 40.84 | | | |
| backfill | 2 | HR | 20.437 HR | 40.84 | _ | | 40.84 | | | |
| | | | | | | | | | | |
| ·Trench | | | | | | | | | | |
| 4" clay pipe - | 25 4 | LF | 21.42 HR | 97.48 | 1.60/LF | \$40.00 | \$ 137.68 | | | |
| excavation | 2 | HR | 20.42/102 | 40.84 | | | 40.84 | | | |
| backfill | 2 | HR | 10.42/ HR | 40.84 | _ | _ | 40.84 | | | |
| | | 86 | 20.47 | | 150 | - | ±00.10 | | | |
| · Distribution box | 4 | HR | 20.42 HR | 81.68 | 150/051 | \$150.00 | [‡] 231.68 | | | |
| excavation | 2 | HR | 20.47 | 40.84 | _ | _ | 40.84 | | | |
| backfill | 2 | HR | 20.42 HR | 40.84 | _ | | 40.84 | | | |
| · Leaching Field | 1/4 | | 04.17 | | 1.00 | | 4 | | | |
| perforated PVCpipe | 140 | LF HZ | 24.47 /HR 2042 | 97.68 | 1.00 /LF | *140.00 | 7237.68 | | | |
| excavation 36x20x1 | 2 | 1112 | | ////// | _ | | 40.84 | | | |
| backfill Waravel | 720 | SF | THR | 40,84 | ·24/5F | \$172.80 | 213.64 | | | |
| backfill covering | 2 | HR | 20.42 HR | 40.84 | _ | _ | 40.84 | | | |
| ·Backhoe rental | 2 | Day | | | 495 DAY | \$990.00 | 990,00 | | | |
| 3/4 CY | | | | | | | | | | |
| | | | | \$889.6A | | \$1912.80 | \$2802.44 | | | |

| CONSTRUCTION COST E | CONSTRUCTION COST ESTIMATE | | | | | | 4 or 4 | | |
|--|----------------------------|-------|------|-------------|--|---|-----------|--|--|
| PROJECT NIN BOUNDARY GRO | 0~0 | AW | TER | i | BASIS FOR ESTIMATE CODE A (No design completed) | | | | |
| LOCATION ROCKY MOUNTAIN ARSEN ARCHITECT ENGINEER | AL-C | omn | ERC | ב כנדץ, כם | | DDE B (Preliminary of CODE C (Final deather (Specify) | | | |
| STEARNS-ROGER | | ESTIM | ATOR | | | | | | |
| DRAWING NO. | | | | E V.W. | | CHECKED BY | | | |
| 1204172714 | QUANT | | | LABOR | | MATERIAL | TOTAL | | |
| ARCH TECTURAL SUMMARY | NO. UNITS | MEAS. | PER | TOTAL | PER | TOTAL | COST | | |
| Summary Sht | | | | | | | | | |
| Sheet | | | | 3854.70 | | F1184.00 | 2038.70 | | |
| + Subcontract \$64,300 | | | | | | | 64,300.00 | | |
| SHEET Z | | | | T496.19 | | 213,38 | * 709.57 | | |
| SHEET 3 | | | У | *889.64 | | \$ 1912.80 | 2,802.44 | | |
| TOTAL | | | | 2,240.53 | | 3,310.18 | 69,850.71 | | |
| Preengneered Blog. | | | | | | | 64,300.00 | | |
| | | | | * | | 5 | | | |
| TOILET ROOM | | - | | 7931.21 | | ₹730.50 | 1,661.71 | | |
| SEWAGE SYSTEM | | | | 889,64 | | 1912.80 | 2,802.44 | | |
| Drinking Fountain | | | | 48.84 | | \$ 265.00 | 313.8 | | |
| EMERG. EYE WASHESHOWER | | | | 48,84 | | *335,00 | 383.8 | | |
| PAINTING | | | | 322.00 | | 3 66.88 | 3.88.88 | | |
| | | | | \$.2,240.53 | | [‡] 33/0.18 | | | |
| TOTAL | | | | | | | 69,850.71 | | |

| CONSTRUCTION COST | DATE PREPARED | 27 | | SHEET | 1 of | 5 | | | | | |
|--|---------------|---------------|-------------|-----------|--|---------|---------------|--------------|--------|--|--|
| PROJECT | | | | | BASIS FOR ESTIMATE | | | | | | |
| GROUND WATER / | EEAT, | ME | م <i>ہو</i> | ACILITY. | CODE A (No design completed) | | | | | | |
| LOCKY MOUNTAI | NA | rese | NA | 4 | CODE & (Preliminary design) | | | | | | |
| ARCHITECT ENGINEER | 4 | | | 266160 | CODE C (Final design) OTHER (Specify) | | | | | | |
| ARCHITECT ENGINEER STEARNS ROGER DRAWING NO. | - Lac | FINA | S STOR | WGL | CHECKED BY | | | | | | |
| DRAWING NO. | | G | J. 1 | VHITTALL | ۷. | | | | | | |
| 5721171211 | QUANTI | | | LABOR | | MATERIA | L | 70 | TAL | | |
| STRUCTURAL SUMMARY | NO. UNITS | UNIT MEAS. | PER | TOTAL | PER | то | TAL | | OST | | |
| EXCAVATION: | | | | | | EQUIP | PHENT. | | | | |
| TRENCHES & GRASE BAS | 78.5 | CY | | | 102 | \$ 8 | 3007 | 8 | 30.07 | | |
| The rest of Change Of the | 3,5 | | 1541 | \$53.94 | | | | ٤ | 53.94 | | |
| BLOG FOUNDS & ROULPHENT | | CY | , - | 7 | 102 | \$ 9 | 2208 | | 55.08 | | |
| CCG WAS & MONEY | _ | MH | 1541 | 4623 | | - | | | 46.23 | | |
| FLOOR & DOORWAYS | 37.0 | | 13 | 7 10 | 043 | \$ | 15.91 | | 15.91 | | |
| LOOK & LOOK WAYS | 20 | 1 | 1541 | \$ 3082 | | Τ, | -,,, | | 30.82 | | |
| | | | | 130 99 | _ | 15 | ماه | | 82.05 | | |
| 4. | 549 | (UT)# | <u>ر</u> | 100/ | | 1 12 | <u> </u> | | (L | | |
| BACKFILL; | 72 | CY | | | 137 | त्र | 1864 | - | 8.34 | | |
| to foundations ETE | | ₹(| 15世 | \$ 3082 | | 1 | 10 | | 30.82 | | |
| | | 771 | 192 | \$ 20~ | | | | | 310 | | |
| STRUCTORAL BACKFILL | 58 | CY | | | 650 | _≰3 | 377∞ | 3. | 77.00 | | |
| STRUCTURE CARRETTE | 1 | MH | 1541 | \$26968 | 0 - | | | | 39.68 | | |
| | 11,2 | 77 | 13 - | 426 | | | | 7. | -7.6 0 | | |
| V B | | | | | | | | | | | |
| VAPOR BARRIER | 27-9 | c +- | | | 180 | \$60 | 7440 | 4.7 | 74.40 | | |
| 4MILS DVC | 3708 | SF | 1-41 | \$12328 | | 400 | / | , | - | | |
| | 8 | MH | 1541 | Q125- | | | | · · · · · · | 25,28 | | |
| CONCRETE: FC 3000 | | | | | | | | | | | |
| | | | | | | | | | | | |
| Comprese With Forms | | | | | | | | | | | |
| & Raubar | 0: - | 1.1 | | | 500 | #10 | 08= | 1 | 508.00 | | |
| FLOOR SLAS | 26.0 | - 7 | 0186 | 1-1-1-24 | 58≌ | \$13 | ,00 | | 743.24 | | |
| | 54.0 | MH | 2186 | \$74324 | | | | | 177.61 | | |
| <u>+</u> - | | | | | 1 | # ~ | 0100 | 17/ | 24000 | | |
| EQUIPMENT FOUNDS | 44 | CY | 2.01 | 400,001 | 65€ | 72 | 860 ≃ | | 850.00 | | |
| , | 129 | MH | 2156 | 2281994 | | | | 7.5 | 119,94 | | |
| | | | | | | ш- | 1 | ļ | /·• - | | |
| DOOR PADS | 7.5 | CY | - 46 | 4/- | 58= | \$ 2 | 135.00 | | (5.30) | | |
| | 10.0 | MH | 2186 | \$ 218 60 | | | YERNMENT PRIN | | 18.60 | | |

| CONSTRUCTION COST ESTIMATE PROJECT GROUND WATER TREATMENT FACIL LOCATION ROCKY MOUNTAIN ARSENAL ARCHITECT ENGINEER STEARNS ROGER DRAWING NO. STRUCTURAL SUMMARY NO. UNIT PER TOTA UNITS MEAS. UNIT TOTA CONCRETE (ONT) BUILDING FOUND'S 81 CY 32 MH 2186 \$66 | 7-/2-82 SHEET 2 OF 5 |
|--|-----------------------------|
| ARCHITECT ENGINEER STEARNS ROGER DRAWING NO. STRUCTURAL SUMMARY NO. UNIT PER UNITS MEAS. UNIT CONCRETE (ONT) BUILDING FOUND'S 81 CY | BASIS FOR ESTIMATE |
| DRAWING NO. DRAWING NO. STRUCTURAL SUMMARY NO. UNIT PER UNIT FOR UNIT PER UNIT FOR UNIT PER UNIT SUMMARY NO. UNIT SUMARY NO. UNIT | |
| DRAWING NO. DRAWING NO. STRUCTURAL SUMMARY NO. UNIT PER UNIT FOR UNIT PER UNIT FOR UNIT PER UNIT SUMMARY NO. UNIT SUMARY NO. UNIT | CODE & (Preliminary design) |
| STRUCTURAL SUMMARY NO. UNIT PER TOTAL SULL SUMMARY NO. UNIT PER UNIT TOTAL SULL SUMMARY NO. UNIT PER UNIT SULL SULL SULL SULL SULL SULL SULL SUL | OTHER (Specify) |
| STRUCTURAL SUMMARY NO. UNIT PER UNIT TOTAL SULL SUMMARY NO. UNIT PER UNIT TOTAL SULL SUMMARY NO. UNIT PER UNIT TOTAL SULL SULL SULL SULL SULL SULL SULL SU | CHECKED BY |
| CONCRETE (CONT) BUILDING FOUND'S STRUCTURAL SUMMARY NO. UNIT PER UNIT TOTAL TTALL |
| CONCRETE (ONT) BUILDING FOUND'S 81 CY | MATERIAL |
| BUILDING FOUND'S 8.1 CY | 000 |
| BUILDING FOUND'S 8.1 CY | |
| | 712 \$575.10 575.10 |
| 1 52 MI 12 46 | |
| | 711- |
| GRADE BA'S & TRENCHES 53 CY | 102= \$5,406 = 5,406.00 |
| | |
| 440 MH 2186 \$96 | 10- |
| # - 10 | 350 \$ 43.75 43.75 |
| GROUT 1" THICK 12:5 SF | |
| | |
| GROUT 2" THICK 708 SF | 7 \$ 4956 9 4,956.00 |
| 227 MH 218 \$49 | 16222 4,962,22 |
| | |
| EXPANSION AND | |
| ISOLATION JOINTS 498 L.F. | 054 \$ 268.92 268.92 |
| 11 MH 2159 \$ 2 | 3749 237.49 |
| JOINT FILL 498 LF | 017 \$ 87.66 84.66 |
| 9 MH 21-59 \$1 | 943 194.31 |
| | |
| STEELWORK. | |
| CURB L FOR RENCHES 240 LF | 391 \$ 7325 732.00 |
| 24 MH 2300 \$5 | 553.44 |
| | |
| Carrie | |
| FOR TRENCHES LATHICK 276.5 SF | 685 \$1894.03 1,894.03 |
| FOR RENCHES 14 HIGH 2/6:35 \$ 2 | 253.66 |
| | 452 \$1406.25 1,406.25 |
| FOR WALKWAYS 1" THICK 312.55= | |
| 22 MH 2306 \$ 5 | 507.32 |
| | 25 \$2150 = 2,150.00 |
| ACCESS LADDERS 86 LF | |
| NO CAGE 33 MH 2300 \$ 70 | 6098 760.98 |

| CONSTRUCTION COST | ESTIMAT | E | | DATE PREPARED 7-/2 | -82 | | | 3 | or 5 |
|----------------------|--------------|---------------|---------|--------------------|------------|--------|------------------|----------|-----------|
| PROJECT GROUND WATER | TRE | at N | 1527 | FACILITY | BASIS FO | | ATE (No desig | | |
| LOCATION | | | | | | | eliminary | | |
| ROCKY MOUNTAIN | | ساق ا | | | _ | CODE C | (Final de | rign) | |
| STEARNS ROGER | 2 | | | | | | | | |
| DRAWING NO. | | EST IM | الدائمة | WHITTAL | CHECKED BY | | | | |
| STRUCTURAL SUMMARY | QUANTI | | | LABOR | | ATERIA | L | | TOTAL |
| SIROC LORAL SUMMARY | NO. UNITS | UNIT MEAS. | PER | TOTAL | PER | 701 | TAL | | COST |
| STEELWORK (CONT) | | | | | | - 17 - | | | |
| HANDRAIL & KICK PE | 230 | LF | | | 2200 | \$50 | 060 = | | 5,030.00 |
| · · | 37 | MH | 2306 | \$ 85322 | | | | _ | 853.22 |
| | | | | | | | | - | |
| ANCHOR BOLTS | | | | | | 17 | | _ | |
| 1" \$ x 18" Long | 40 | EA | | | 350 | # | 1449 | _ | 144.00 |
| | 22 | MH | 2159 | \$47498 | | | | | 474.98 |
| 1" \$ x 24" Loug | 16 | EA | | 1 40 | 425 | \$ | 68= | 1_ | 68.00 |
| | 10 | MH | 2159 | #21590 | | 1, | | _ | 215.90 |
| 3/4 × 18 Long | 24 | EA | | , 10 | 235 | \$ | 56.40 | _ | 56.40 |
| | 10 | MH | 2159 | \$ 21590 | | | | _ | 215.90 |
| | | | | | | | | - | |
| EXPANSION BOLTS | | | | | | | | <u> </u> | |
| 3/4 × 7"L= 200 | 16 | EA | | | 380 | | 60.80 | <u> </u> | 60.80 |
| Deilling | 16 | EA | | | 047 | | \$ 7.52 | _ | 7.52 |
| | 5 | MH | 2159 | \$ 10795 | | | | ļ | 107.95 |
| | | <u> </u> | | | | | | _ | |
| STEEL FRAMING TO | | <u> </u> | | | | / | | <u> </u> | |
| WALKWAYS | 4402 | 1 1 | | | 000 | \$26 | 41.20 | 1_ | 2,541.25 |
| | 75 | MH | 215 | \$ 161925 | | | | ├_ | 1.619.25 |
| | | <u> </u> | | | | | | _ | |
| | | | | | | | | - | |
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| | | | | | | | | - | |
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| | | | | | | | | _ | 11 |
| | | | | 3,487.20 | | 8,0 | 37.92 | _ | 11,525,12 |
| | | | | | | | | | |

| CONSTRUCTION COST | STIMAT | E | | DATE PREPARED | -82. | | SHEET | 4 0 5 |
|---|------------------------|---------------------|---------------|---------------|----------|--------|------------------------------|---------------|
| PROJECT GROUND WATER TRES LOCATION | ATM | /2~7 | + FA | CILITY | BASIS FO | CODE A | . (No desigr reliminary d | |
| LOCATION ROCKY MOUNTAIN ARCHITECT ENGINEER STEARNS ROGE | <u> </u> | | , O R E | | | CODE C | (Final dea | ign) |
| DRAWING NO. | | ESTIM | ATOR J. | Wrutge | 722 | CHECKE | OBY | |
| STRUCTURAL, SUMMARY | QUANTI NO. UNITS | TY UNIT MEAS. | PER | LABOR | | TO: | TAL | TOTAL COST |
| SLAB FOR PR | pA | VE | S | TORAGE | TA | NK | | |
| EXCAVATION: | 4 0NE | ج.> ۸۲ | 1541 | \$1541 | 103 | \$\$ | 4º8 | 4.08 15.41 |
| STRUCTURAL BACKFILL | 1.33 ONE | | /5 <u>4</u> ! | \$15-1 | 650 | Ħ | 865 | 8.65 15.41 |
| VAPOR BARRIER 4 MILS PV.C | 72 ONE | s,F. | 154 | \$ 1541 | /80 | \$ | 12960 | 129.60 |
| CONCRETE fc' 3000 COMPLETE WITH | 2.67 | CV | | | 65° | \$ | 17355 | 173.55 |
| FORMS & COEAR | , | | | \$ 2178 | | \$3 | 5/5 <u>8</u> 8 | \$53377 |
| | | | | | | | | |
| | | | | | | | | |
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| | | | | | | | | |
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| | | - | | | | | | |

| CONSTRUCTION COST | ESTIMA | ΓE | | DATE PREPARED | -82 | SHEET | 5 0 5 | | |
|---|---------|--|--------------|--|-----------------------|-------------|---------------|--|--|
| PROJECT | | | | | | ATE | | | |
| GROUND WATER | REA. | TME | NT | FACILITY | CODE | . (No desig | n completed) | | |
| LOCATION | 1 | 0 c 🗪 | 101 | , , | CODE & (P | | | | |
| ROCKY MOUNTAIN ARCHITECT INGINEER | / F3 K | 208/ | <u> </u> | | CODE C (Final design) | | | | |
| STEARNS ROG | ER | | | | | | | | |
| DRAWING NO. | | ESTIM | ATOR | WHITTA | CHECK | ED 8Y | | | |
| | QUANT | | | LABOR | MATERIA | \L | 1 | | |
| STRUCTURALSUMMARY | NO. | UNIT | PER | TOTAL | PER TO | TAL | TOTAL COST | | |
| | UNITS | MEAS. | UNIT | | UNIT | | | | |
| TOTHLS | | | | | | | | | |
| | | | | | | | <i></i> | | |
| SHEET I | | | | \$4336.55 | 12,1 | 04.10 | \$16,440.65 | | |
| | | | | | | | , ' | | |
| SHEET Z | | | | \$17852 92 | 17 | 516.71 | 135,369.63 | | |
| 27347 2 | | | | 4.70== | 17 | | | | |
| 5/- 3 | | | | \$348720 | 20 | 23792 | 811525,12 | | |
| SHZET 3 | | | | 45707 | , · | .,,,, | | | |
| | | | | 21200 | | 315.88 | 533.77 | | |
| SHEET 4 | | | | 217.89 | | 13.00 | 333.77 | | |
| | | | | | | 54111 | 120.00 | | |
| | | ļ | | 25,894.56 | 37,6 | 774.61 | 63,869.17 | | |
| | | | | | | , | | | |
| EXCAVATION FROM PG 1 | | | | 130 99 | 1 | 5,06 | 282 05 | | |
| | | | | | | | | | |
| NET STRUCTURAL | | | | 25, 76357 | 37 | 823 55 | 63,587 1 | | |
| WET STRONG WAY | | | | | | | | | |
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| ACCEPTION APSENDA | | ENVE | ek Co | occ. | CODE B (Preliminary design) | | | | |
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| | QUANTI | TY | 12 | LABOR M. H. | | MATERIA | | | |
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| SURTOTAL PAGE 2 | | | | 123.5 | | 464599 | | | |

| CONSTRUCTION COST | | DATE PREPARED 7-13-82 | , | | SHEET | 3 of 3 | | |
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| PROJECT NW BOUNDARY TREATMENT F | | | | | BASIS FO | CODE | | completed) |
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| PROJECT NORTH WEST BOULD LOCATION LOCKY MOUNTAIN ARCHITECT ENGINEER | WOARY | | ONTA | INMENT/ | | CODE A (No design | | |
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| 3/4" V2" | 107.0 | LE | . 19 | 20.33 | 1.62 | 173.34 | | |
| 1/2" | 15-0 | LF | .16 | 2.40 | 1.17 | 17.55 | | |
| FITTINGS | | | | | | | | |
| WROJGHT COPPER | | | | | | | | |
| SOLDER YOUNT | | | | | | | | |
| ANSI B16.22 | | | | | | | | |
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| 3/4" | 8 | ĒA | . 42 | 3.36 | .38 | 3.04 | | |
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| CONSTRUCTION COST | ESTIMAT | ΓE | | DATE | PREPARED | ハラーと | V SHEET | 2 of 5 | | |
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| PROJECT | | | | | | | R ESTIMATE CODE A (No design DE B (Preliminary de | | | |
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| 3/4" | 2 | EA | ,44 | | .38 | 1.82 | 3.64 | | | |
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| 125 # BRONZE | | - | | - | | | | | | |
| SOLDER VOIHT | | | | | | | | | | |
| 1/2" | 3 | EA | .33 | | .99 | 11.50 | 34.50 | | | |
| 3/4" | 2 | EA | .40 | | .80 | 11.75 | 29,50 | | | |
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| PROJECT / 2 | | | | BASIS FOR ESTIMATE | | | | | |
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| LOCATION ROLLY MOINTAIN | 10 | REAL | TME | CODE C (Final design) | | | | | |
| ARCHITECT ENGINEER | 16351 | 42 | | | OTHER (Specify) | | | | |
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| ASTM A-74 HUB. | | | | | | | | | |
| W/PLAIN END SPIGOT | | | | | | | | | |
| SERVICE WEIGHT | | | | | | | | | |
| CAR VIVE WARE | | | | | | | | | |
| 4' x 6'-6" | 3 | EA | 2.36 | 7.08 | 4.68 | 91.26 | | | |
| | | | | | | | | | |
| 4' × 6-0" | 2 | EA | 2.18 | 4.36 | 4.68 | 56.16 | | | |
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| 4' x 5 : 0" | 3 | EA | 1.82 | 5.46 | 4.60 | 70.20 | | | |
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| 4 x 10'0" | 2 | EA | 3.64 | 7.28 | 4.68 | 93.60 | | | |
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| FITTINGS | | | | | | | | | |
| CAST IRON ASTM | | | | | | | | | |
| A-74 SERVICE WEIGHT | | | | | | | | | |
| THE SERVICE MILITARY | | | | | | | | | |
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| 4'x 1-0" | 1 | EA | 136 | 1.44 | 4.68 | 18.72 | | | |
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| 4×1-6" | 4 | EA | .55 | 2,2 | 4.68 | 28.03 | | | |
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| 4", 21/3"(A5 1') | 4 | EA | .36 | 1-44 | 4.68 | 4.68 | | | |
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| PROJECT | | | | | BASIS FOR ESTIMATE | | | | | |
| | | | | | CODE A (No design completed) | | | | | |
| LOCATION | | | | | CODE & (Preliminary design) | | | | | |
| ARCHITECT ENGINEER | | | | | CODE C (Final design) OTHER (Specify) | | | | | |
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| ARCHITECT ENGINEER | STEAR | | 0G E | n | 26616 | | | | |
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| 24 DIA | | 130 | LF | .36 | 64.8 | .60 | 108. | 00 | |
| 4" DIA | | 165 | | 11.3 | 700 | 1.80 | 107 | | |
| A DIA | | 16. | | . 48 | 70.2 | 1.80 | 297. | 00 | |
| 6" 312 | | 226 | LF | . 57 | 128.82 | 3,44 | 777. | ry | |
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| 10" 314 | | 20 | LF. | . 23 | 16.60 | 7.75 | 55.0 | 0 | |
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| PROJECT | | | | | | R ESTIMATE | | | |
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| ARCHITECT ENGINEER | | | | CODE B (Preliminary deelgn) CODE C (Final deelgn) | | | | | |
| ARCHITECT ENGINEER | | | | | OTHER (Specify) | | | | |
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| | QUANT | | | LABOR M.H. | | MATERIAL | TOTAL | | |
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| 11/2" DIA | R | EA | .62 | 4.96 | 2.14 | 17.12 | | | |
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| NU DIA | 30 | EA | .73 | 21.90 | 2.92 | 17.50 | | | |
| 4º DIA | 20 | EA | 1.33 | 75.00 | 15.63 | 312.60 | | | |
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| 6 DIA | 14 | EA | 2.19 | 74.96 | 35.65 | 255.60 | | | |
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| 12 DIA | 4 | EA | 4.8 | 19.20 | 214.47 | 257.92 | | | |
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| 45° ELL (SLIP) | | | | | | | | | |
| -3 500 (3011) | | - | | | | | | | |
| 24 DIA | 10 | E.A | .73 | 7.3 | 2,02 | 29.20 | | | |
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| 14 | | | | | | | | | |
| 24 DIA | 10 | EA | 1.14 | 11.40 | 3.39 | 33.90 | | | |
| 4° DIA | 12 | EA | 2 | 24 | 25.60 | 307.20 | | | |
| | _ | | | | | | | | |
| 6° 71A | 9 | ΕJ | 3.2 | 28.2 | T1.63 | 461.07 | | | |
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| 10" DIA | 1 | EΔ | 4.8 | U.8 | 99.92 | | | | |
| | | | | 621.24 | | 5 5 7 3 51 | | | |

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| ARCHITECT ENGINEER | | | | | CODE C (Final design) | | | | |
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| A" DIA | 13 | - | 7.33 | 10,0 | 106 | 7.4.7.7.0 | | | |
| 6 DIA | 20 | = 1 | 1 0 | 1// | (22 | 307.40 | | | |
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| n V . | | | 2 | (1) 0 | 17 -1 | 4 . (2 2 | | | |
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| 12" 314 | 12 | EA | 4.0 | UB.0 | 201,49 | 353.28 | | | |
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| REDUCER BUSHIN | 9 | - | | | | | | | |
| (SPIGK SLIP) | | | | | | | | | |
| | | | | _ | | | | | |
| O'XB" DIA | 3 | EA | 3,5 | 10.5 | 62.21 | 186.63 | | | |
| , | | | | | | | | | |
| 12 NB DIA | 1 | EA | 4.00 | 4.0 | 132.14 | 132.14 | | | |
| | | | | | | | | | |
| 12 × 10 DIA | 1 | EA | 4.00 | | 99.54 | | | | |
| 6" x 4" DIA | 6 | EA | 2.30 | 13.8 | 12.20 | | | | |
| | | | | 806.09 | | 7 297.82 | | | |

| CONSTRUCTION COST | ESTIMA | TE | | DATE PREPARED SHEET 4 | | | | 7 of 15 | |
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| PROJECT | | | | | BASIS FO | R ESTIM | ESTIMATE | | |
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| REDUCING (SLIP) | | | | | | | | | |
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| B' 16" DIA | 3 | EΔ | 岁.0 | 9.0 | 21.28 | 6 | 3.84 | | |
| 10' K 8' DIA | 1 | EA | 3.2 | 3.2 | 24.24 | e | .4.24 | | |
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| GRY" DIA | 6 | EA | 2.3 | 13.80 | 12.20 | 7 | 3.20 | | |
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| 4" DIA | 60 | EA | . 66 | 39.6 | 16.04 | 962.40 | | |
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| MALE TYPE W/N.P.T. | | | | | | | | | |
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| 4" | 2 | EA | 2.9 | 5.8 | 5604 | //: | 2.08 | | |
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| 22" | / | EA | 1.6 | 1.6 | 21.22 | 21 | 1.22 | | |
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| OPN CAP-631B | | | | | | | | ## · · · · · · · · · · · · · · · · · · | |
| MITERIAL -ALUM. | 5 | | | | | | | | |
| MISTERIAL -ALUM. | | - | _ | | | | | | |
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| IN PUC WAFFER | | | | | | | | | |
| TYPE WITH METAL | | | | | | | | | |
| HANDLE 4 DIA | 17 | EA | 2.82 | 47.94 | 101.70 | 1724.9 |) | | |
| TYPE WITH METAL HANDLE A' DIA (+GF+#367) | | | | | | | | | |
| | | | | | | 2.1.6 | | | |
| DITTO 6" DIA | 6 | EA | 3.3 | 10.80 | 161.10 | 966.60 | | | |
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| 2411 114115 | | | | | | | | | |
| BALL VALUE | | | | | | | | | |
| IN PUC SINGLE | | | | | | | | | |
| TA DIY | 6 | EΔ | . 35 | 2.10 | 23.13 | 137.77 | | | |
| IN PUC SINGLE UNION VITON SEAL (GF #345) | | 1 | 1.75 | 1 | | | | | |
| (91) | | | | | | | | | |
| DITTO 1/2' DIA | 6 | EA | 40 | 2.40 | 37.04 | 227.0 | | | |
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| SWING CHECK | | | | | | | | | |
| VALUE IN PUC | | | | | | | | | |
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| SPRING BALANCED | | | | | | | | | |
| DISC FLAHRED | | | | | | | | | |
| 4" DIA | | EA | 3.25 | 3.25 | 550. | 550.∞ | | | |
| (PPS FIG 084134 L) | | | | | | 11 2 == == | | | |
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| DITTO 6" DIA | 4 | EA | 4.95 | 19.80 | 1050 - | 4 | 2000 | | |
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| 2" DIA | | | | | | | | | |
| (GF# 550) | 3 | EA | . 47 | 1.41 | 30,60 | | 91.20 | | |
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| DITTO FOR 6" PIPE | 3 | EA | 5.2 | 15.6 | 70 au | | 21000 | | |
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| PREFAB IN SPOOLS | | | | | | | - | | |
| 2' DIA | | | 20 | 105,30 | 14.91 | 4025.70 | | | |
| (b' LONG PES) | 270 | LE | ,39 | 105,35 | 7.71 | 10 21.10 | | | |
| 4" DIA | 35 | LF | -69 | 24,15 | 29.33 | 1026.55 | | | |
| 4" DIA (6' Love Pes) | | | | | | | | | |
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| -IDECC V VIA | 170 | 1=1 | 107 | 10.00 | 07,3 | 0,100 | | | |
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| PROJECT | | | | | BASIS FO | RESTIMATE | | | |
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| PROJECT | | | | | | OR ESTIM | | | |
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| PROJECT NORTHWEST BOU | NOAR | / | | | | R ESTIMATE | | |
| CONTAINMENT/TRO | | | | | | CODE A (No design | | |
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| ARCHITECT ENGINEER STEARNS-ROGE | ER | | | | OTHER (Specify) | | | |
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| LIGHTING FIXTURES | SHEET | 2 | | 1359 | | 1325 | | |
| DISTRIBUTION | 11 | 2 | | 2712 | | 10450 | | |
| DEVICES | /1 | 2 | | 230 | | 706 | | |
| LIGHTNING PROTECTION | // | 2 | | 2885 | | 1788 | | |
| GROUND GRID | 11 | 3 | | <i>2835.</i> | | 1230 | | |
| WIRE & CONDUIT | " | 3 | | 7074 | | 2277 | | |
| MOTOR & CONTROL | 11 | 3 | | 576 | | | <i>A</i> | |
| TOTAL BARE COST = | | | , | 17,671 | | 7,776 | \$35,447 | |
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| ELECTRICAL SUMMARY | NO. UNITS | UNIT MEAS. | PER Unit | TOTAL | PER | TOTAL | COST | |
| LIGHTING FIXTURES | | | \$ | | <i>S</i> | | | |
| 150 W HPS | 6 | EA | 180 | 1080 | 150 | 900 | | |
| COE TYPE WR- ENTRY | 1 | EA | 60 | 60 | 40 | 40 | | |
| EXIT SIGN W/POWER PACK | D / | EA | 53 | 53 | 250 | 250 | | |
| COE TYPE R-2D FIXT. | 1 | ΕA | 53 | 53 | 15 | 15 | | |
| COE TYPE VG-4 | 1 | EA | 53 | 53 | 45 | 45 | | |
| RECESSED HEAT LAMP FOR LAVRATORY | 1 | EA | 60 | , 60 | 75 | 75 | | |
| DISTRIBUTION | | | , | 1359 | | \$ 1325 | | |
| 20 CKT LTG PNL. | 1 | EA | 600 | 600 | 950 | 950 | | |
| IOKVA DRY-TYPE TRANS | 1 | EA | 312 | 312 | 500 | 500 | | |
| MCC, 3-VERT. SECT. | / | EA | 1800 | | 9000 | 9000 | | |
| | | | | \$ 2,712 | | \$10450 | | |
| DEVICES | | | | ., | | | | |
| SWITCH-BOX-COVER | 4 | EA | 12 | 48 | 40 | 160 | | |
| DUPLEX RELP-BOX-COVER | 13 | EA | 14 | 182 | 42 | 546 | | |
| | | | | \$ 230 | | \$ 7.06 | | |
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| LIGHTNING PROT. | | | | | | | | |
| CADWELDS & MISC. | 50 | | | | 3 | 150 | | |
| CLASS I CONDUCTOR | 400 | FT | | | | 400 | | |
| CU AIR TERMINALS | 12 | EA | <u></u> | | 5 | 60 | | |
| | 12 | EA | | | 17 | 204 | | |
| POINT BASES | | | | | 2 | 260 | | |
| CABLE HOLDERS | 130 | EA | | | | | | |
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| CONSTRUCTION COST | | | DATE PREPARED 7-12-82 s | | | 3 or 3 | | | | |
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| PROJECT NORTHWEST | | | , | | BASIS FO | BASIS FOR ESTIMATE | | | | |
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| ARCHITECT ENGINEER STEARNS-ROGE | | | -/- | | OTHER (Specify) | | | | | |
| DRAWING NO. | | ESTIM | M 2 | EW | CHECKED BY | | | | | |
| | QUANT | TY | | LABOR | MATERIAL | | | | | |
| ELECTRICAL SUMMARY | NO. UNITS | UNIT | PER | TOTAL | PER | TOTAL | TOTAL COST | | | |
| GROUND GRID | | | ₹ | | 翠 | | | | | |
| #2/050BC CROSS-RUN | 200 | LF | 1.56 | 312 | 1.35 | 270 | | | | |
| #4/0 SDBC PERIM. RUN | | | 1.92 | 576 | | 660 | | | | |
| BOLTED CONNS. ABOVE GRAC | FJOB | HRS | 24.04 | 1442 | | 100 | | | | |
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| | | | | 2835 | | \$ 1230 | , | | | |
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| WIRE & CONDUIT | | | | | | | | | | |
| 3" RGS CONDUIT & FITTINGS | | T | | 1200 | 4.50 | 450 | | | | |
| 12" RGS " " | | | 5.75 | 1150 | 1.55 | 310 | | | | |
| 1" RGS (TEL. CONDUIT) | | - | 3.60 | 216 | | 60 | | | | |
| 3/4" RGS CONDUIT & FITTINGS | 1000 | LF | 3.35 | 3350 | 0.80 | 800 | | | | |
| I" RGS CONDUIT & FITT- | | | 3.60 | 180 | 1.00 | 50 | | | | |
| 1/2"LIQUIDTIGHT FLEX | | | 7.90 | | | 120 | | | | |
| 3/4" " " | 12 | L /= | 3,60 | 43 | 1.90 | 23 | | | | |
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| WIRE, THHN-THWN: | | | | | | | | | | |
| # GAWG | 800 | | | 240 | | 224 | | | | |
| #10 AWG | 1000 | | | 220 | | 120 | | | | |
| #12 AWG | 1500 | LF | 0.19 | 285 | 0.08 | 120 | | | | |
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| 11.702 4 2-1-703 | | | | | | | | | | |
| MOTOR & CONTROL | | 12 | الد مار | | | MATERIAL | | | | |
| MOTOR HOOKUP | JOB | | | 288 | | MATERIAL | | | | |
| CONTROL CKT HOOKUP | JOB | HRS | 24.04 | 288 | _ | ABOVE | | | | |
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ARMCO BUILDING SYSTEMS

J. SHELBY WELCH, JR. District Manager

July 7, 1982

Stearns Roger Engineering Corporation P. O. Box 5888
Denver, Colorado 80217

Attention: Mr. Steve Van Winkle

Reference: Northwest Boundary Ground Water Control System

Rocky Mountain Arsenal Project No. C26616

Gentlemen:

In accordance with your request, we are pleased to submit for your consideration the following estimate for the above referred to project:

One complete Armco building, type RF-80, size 40'-0" wide x 72'-8" long x 30' high, designed for 30# LL and 25# WL per UBC. The roof panels to be 24 gage ALUMINIZED steel with standing seams and concealed fasteners. The wall panels to be 24 gage galvanized steel with interlocking ribs, concealed fasteners and factory finish color coating with a 20 year warranty. Both endwalls to be designed for future expansion. The following accessories are included:

- 3 3070 single swing steel doors with top half glazed and necessary hardware
- 1 10' x 14' overhead sectional steel door insulated
- 1 12' x 24' overhead sectional steel door insulated
- 1 30' length of 12" throat ridge vent with damper and birdscreen
 - Gutters and downspouts for both side walls
 - Roof insulated with 3" fiberglass blanket to meet U factor of 0.10
 - Walls insulated with 3" fiberglass batts to meet U factor of 0.15
 - Steeliner to protect insulation up to 8' high around perimeter of building

All of the above delivered and erected on foundation by others for the sum of\$63,000.00

At the present time and subject to prior orders received, shipment can be made in approximately six weeks.

Stearns Roger Engineering Corporation July 7, 1982 Page 2

We thank you for the opportunity to present this information. Please contact me if you have further questions.

Cordially,

JSW:mp

Enclosures

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ARMCO BUILDING SYSTEMS

J. SHELBY WELCH, JR. District Manager

July 8, 1982

| REFER TO | 1 | NOTE |
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| Gen. Files | | |
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Stearns Roger Engineering Corporation P. O. Box 5888
Denver, Colorado 80217

Attention: Mr. Steve Van Winkle

Reference: Northwest Boundary Ground Water Control System

Rocky Mountain Arsenal Project No. C26616

Gentlemen:

Supplementing our letter of July 7, please be advised that to increase the length of building to 77'-8" (3 bays @ 25") the cost would be increased by \$1300.00.

Cordially,

JSW:mp

QUOTATION GGOULDS PUMPS, INC.

VERTICAL SUMP PUMP

REPLY TO:

PIONEER EQUIPMENT, INC. P.O. Box 27024 Tucson, AZ 85726

Attn: Dick Cahill

All quotations subject to terms and conditions on the reverse side and expire unless accepted within 30 days from date of quotation. All quotations subject to change with or without notice.

Rubel and Hager, Inc. Date: 7/8/82 Page: 4400 E. Broadway Proposal No.: Tucson, AZ 85711 Revision No.: Mr. Frederick Rubel, Jr., P.E. Attention: Copies: Goulds Denver Inquiry Date: Item No.: P-101, 102, Inquiry No.: Rocky Mr. Arsenal Pioneer Equip, 103,104. In answer to your inquiry, we propose to furnish GOULDS PUMPS as described below: CONDITIONS OF SERVICE -Water HQUID Sp. Gr. @ 60°F 1.0 500 PH Value Solids %. GPM. 162 Solids Size Sp. Gr. @ P.T._ Abrasives_ Visc. @ P.T._ Pumping Temp. PUMP DESCRIPTION -CONTROL EQUIPMENT: Steady Bearing Efficiency. Lubrication QUANTITY_ 3171 Std. 28.8 Support Plate_ Float Switch # B.H.P & Rating. MODEL Size 3X4-13 None None 32.3 Max. B.H.P. Alternator = Pit Cover Case Cast iron None Hi Water Alarm = Group impeller_Cast iron None * Wet - Dry Single Cont. Voits Pit Type. IMPELLER DIAMETER: 12 fto. Steel None Mag. Start Size_ Pit Depth_ Carbon 22 Approx : Rating_ NEMA Encl. Assembly No. 1182-3 10 / 13 Min. / Max._ For detailed specifications see Bulletin DRIVER -3/60 Voits 230/460 40 1750 Phase/Hz 324 Furnished by Goulds Enclosure. PRICES ARE F.O.B. LUBBOCK, TEXAS UNIT PRICES -Pre-paid job site Weight, pounds: SHIPMENT: 6-8 weeks after COMPLETE PRICE EACH 1926 complete engineering and manu-AS DETAILED ABOVE 5.332.00 facturing information and full approval to proceed with work. FREIGHT (estimated)

TOTAL XXXXXXX QUANTITY FOUR 21.328.00 TOTAL WEIGHT 7704

PIONEER EQUIPMENT, INC.

TERMS. 30 DAYS NET
PER APPROVED CREDIT

Dick CCWill
Richard J. Cahill
Sales Representative

FILTEMP SALES, INC.

filtration • flow • heat • control

5-101 A,B 5-102 A,B 5-103 A,B

MAILING ADDRESS: P.O. BOX 15173 PHOENIX, ARIZONA 85060

July 8, 1982

OFFICE: 3601 S. 42ND STREET PHOENIX, ARIZONA 85040

RECEIVED

Rubel & Hager 4400 E. Broadway, Suite 602 Tucson, Arizona 85711

JUL 12 1982

RUBEL & HAGER, INC.

Attention: Mr. Fred Rubel

Reference: Rocky Mountain Arsenal

Northwest Boundary Treatment System

Dear Mr. Rubel:

We are pleased to quote the following Filterite Equipment per your request.

A Qty

6 Filterite Model 66MSO3-316-4FD-C150
Code Vessel - 316SS - 150 # Operating Pressure
1" NPT Vent - 1 1/2 " NPT Drain - 316SS
Top Seat Plate & Springs - Ethylene Propylene
Gasket - "UM" stamp standard - includes eye nuts Houses 22-30" cartridges - See Bulletin 1762.

Price each: \$4,550.00 Qty--6 at:\$ 27,300.00 Est Frt - Total: \$580.00

6 Sets of Cart (U100AW30U) : \$800.00

Total Cost: \$28,680.00

Option \underline{B} same as item A except Vessel is 304SS instead of 316SS.

Price each: \$3,761.00 Qty--6 at: \$22,566.00 Est Frt - Total: \$580.00

6 Sets of Cart (U100AU30U) : \$800.00

Total Cost: \$23,946.00

C Replacement Cartridges

Filterite U100AW30U 100 Micron - 30" length - Polypropylene Core and Polypropylene Wind July 8, 1982 Rubel & Hager Page 2

Lot Price, 150 Cart : \$975.00 F.O.B. Phoenix

Both Item A and Item B include non code stamp at no additional charge. If you require "U" stamp then please add \$250.00 to total cost. In my opinion the "UM" stamp is more than sufficient. Please contact our office if we can provide further information.

Sincerely,

George R. Metro Filtemp Sales, Inc.

nam

Westvāco

July 9, 1982

Mr. Fred Rubel Rubel & Hager, Inc. 4400 E. Broadway, Suite 602 Tucson, AZ 85711

Dear Fred:

In accordance with your request, I have enclosed a proposal for a Westvaco Pulsed Bed Adsorption System for the Northwest Boundary Containment Treatment Facility, Rocky Mountain Arsenal. Included is a budget estimate of the uninstalled cost of this equipment.

If you require further information or details, please contact me.

Sincerely yours,

Michael L. Massey, Ph.D., P.E. Manager, Carbon Systems

MLM/sa Enclosure

Chemical Division
Carbon Department
Covington, Virginia 24426
Telephone: 703-962-1121

PROPOSAL FOR A WESTVACO PULSED BED ADSORPTION SYSTEM

PROVIDED BY

WESTVACO CORPORATION
CARBON DEPARTMENT
CARBON SYSTEMS GROUP
COVINGTON, VIRGINIA 24426

FOR

ROCKY MOUNTAIN ARSENAL

NW BOUNDARY TREATMENT SYSTEM

COMMERCE CITY, COLORADO

JULY 9, 1982

Introduction |

Westvaco has been requested to prepare a proposal, including budget estimate, for a Westvaco Pulsed Bed Adsorption System. This system will provide carbon adsorption treatment of groundwater at the proposed NW Boundary project at Rocky Mountain Arsenal, Commerce City, CO.

The treatment process will consist of the following:

- A. Three standard pulsed bed adsorption columns.
- B. Two carbon storage tanks, one for fresh carbon and one for spent carbon.
- C. A dual blowcase assembly for carbon transport.
- D. 150,000 pounds of virgin carbon, Nuchar WV-G.

The price covers the cost of delivery of assembled treatment modules as described in the process description. It does not cover the cost of on-site installation. Details of the proposed system are as follows:

Process Description

The Westvaco Pulsed Bed Adsorption System shall include the following standard Westvaco components as required by the specifications:

A. Adsorption Unit

- The carbon adsorption system shall be three upflow Pulsed Bed Systems as manufactured by Westvaco.
- Each 42,000 lb contactor unit shall be a ten-foot diameter 1400 cu ft capacity ASME 50 psig Design Pressure Vessel with potable water lining.
- 3. Influent and effluent connections shall be designed to insure even flow distribution.

- 4. Each adsorber shall be mounted on a support structure designed to support the contactor and all piping and attached equipment under all operating conditions. The support structure shall be designed to provide ready access to piping and valves.
- 5. Connections to each adsorber shall be as follows:
 - a. Raw water inlet and treated water outlets shall be four 6-inch connections.
 - b. Fresh carbon inlet and spent carbon outlet connections shall be 2-inch and properly designed to facilitate carbon handling.
 - c. Three 1/2-inch 316SS sample nozzles are to be spaced at the quarter points of the adsorber, with the nozzle penetrating 6 inches into the carbon bed.
- 6. Each adsorber shall be furnished with two 20-inch diameter manholes—one manhole to be located on the top of the vessel and the other on the side near the bottom of the vessel. An access ladder in conformance with applicable safety standards shall be provided for the top manhole.
- B. Fresh Carbon Storage Tank
 - 1. One ten-foot diameter 740 cu ft capacity fresh carbon storage tank shall be provided. The tank will be an open top cone-bottom vessel suitable for storing a minimum of 20,000 lb (dry weight) of spent carbon. A full water level will be maintained in the tank by a float valve.
 - 2. The tank shall be of all-welded carbon steel construction with potable water lining.
 - 3. The structure and baseplate shall be designed to support the tank, tank contents, and attached equipment under all operating conditions. Lugs, adequate for all lifting and moving the tank, shall be provided.

- 4. Connections to the fresh carbon storage tank shall be as follows:
 - a. The bottom carbon outlet shall be 4-inch diameter (minimum)
 - b. A 2-inch diameter raw water connection
 - c. The tank overflow shall be 4-inch diameter and shall be located above the normal liquid level. The outlet shall be screened to prevent loss of activated carbon.
- C. Spent Carbon Storage Tank
 - 1. One ten-foot diameter 740 cu ft capacity spent carbon storage tank shall be provided. The tank will be an open top cone bottom vessel suitable for storing a minimum of 20,000 lb (dry weight) of spent carbon. A full water level will be maintained in the tank by a float valve. Removal of spent carbon will be by the use of an eductor.
 - 2. The tank shall be all-welded carbon steel construction with potable water lining.
 - 3. The structure and baseplate shall be designed to support the tank, tank contents, and attached equipment under all operating conditions. Lugs, adequate for all lifting and moving of the tank, shall be provided.
 - 4. Connections to the spent carbon storage tank shall be as follows:
 - a. The bottom carbon outlet shall be 4-inch diameter (minimum)
 - b. A 4-inch diameter raw water connection
 - c. The tank overflow shall be 4-inch diameter and shall be located above the normal liquid level. The outlet shall be screened to prevent loss of activated carbon.

D. Carbon Transport System

- 1. The carbon transport system shall consist of separate fresh and spent carbon blowcases to transfer carbon slurry from the fresh carbon storage tank to each adsorber unit and from each adsorber unit to the spent carbon storage tank. Carbon transport will be by air pressurization and eductors. Normal pulsing operation will consist of transporting 2,000 lb of dry carbon per cycle.
- 2. The blowcases shall be 70 cu ft capacity ASME 50 psig Design Pressure Vessels. All wetted parts of the vessels shall be 316 L stainless steel. The pressure vessels shall be stamped in compliance with ASME Code.
- 3. A common support structure and baseplate shall be provided for the two blowcases. The support structure and baseplate shall be designed to support the blowcases, contents, and all attached piping and appurtenances under all operating conditions. The support structure shall be carbon steel. Lifting lugs, adequate for all lifting and moving of the blowcases, shall be provided.
- 4. Each blowcase shall be provided with a 16-inch diameter quick-opening, hinged manhole for top access and observation. An access ladder and platform, designed in conformance with applicable safety standards, shall be provided.

E. Granular Activated Carbon

Westvaco shall supply and install an initial inventory of 150,000 lb of virgin granular activated carbon. The initial carbon supply shall be Westvaco Nuchar WV-G.

Price

The estimated cost for the equipment as described in this proposal is \$638,000, FOB job site.



J & B SALES CO.

TELEPHONE 602 • 258-1545

| JOB Rocky Mountain Arsenal | | Anna Paris | e 2 1 1 of 2 1 |
|----------------------------|-----------------|-------------------|----------------|
| N.N. Boundry Treatment S | ystem Ard | Rubel & Hager | |
| P-105 | English English | Rubel & Hager | |
| Quote No. 2106 | Date | 7-8-82 Due | 7-9-82 |
| Quan | Description | The second second | Net Price |

Rubel & Hager, Inc.

4400 E. Broadway Suite 602"

Tucson, AZ 85711

Attn: Mr. Fred Rubel

Bell & Gossett Model 1531 - 2AC Close Coupled Pump.
Duty: 175 gpm @ 175' TDH 5,200' Elev.
15 HP 460/3/60 3500 rpm ODP Motor

Total Price FOB Factory, FFA Commerce City, Colorado. . \$1,600.00

QUOTATION



P.O. BOX 310, QUAKER RD., GLENS FALLS, N.Y. 12801/TEL. 518-793-8801/TELEX 145339

Mr. Fred Rubel RUBEL & HAGER 4400 East Broadway Suite 602 Tucson, AZ 85711 July 8, 1982

Quotation Number: Q82-041T

5-104

QTY. UNIT PRICE TOTAL

1 AES Model 5250S20A2 Multiple Filter 70,133.00 with external backwash

Application: Granular Activated Carbon

Pressure Rating: 25 psi (operating pressure)

Flow: 1500 gpm

Fabrication: 316 stainless steel

Construction: 20 barrels; assembled and mounted

on a mild steel frame.

Inlet/Outlet Header Size: 12" flanged External Backwash Header: 2" threaded

Drain Size: 2-1/2" threaded

Media: .003" wedge wire

Valve Size & Seats: 2" Teflon

Seals: EPDM

Gauges: 0-400 psi

Filter Media Area: 8160 sq. inches

Backwash Automation (Time Clock and Differential

Pressure Switch)

Option:

Service Step 500.00

Reference Drawing: D-10640

WARRANTY: ALBANY ENGINEERED SYSTEMS WARRANTS ALL AES PRODUCTS AGAINST DEFECTS IN MATERIALS AND WORKMANSHIP IN NORMAL USE FOR ONE YEAR FROM DATE OF SHIPMENT, SUCH WARRANTY BEING LIMITED TO REPLACEMENT OR REPAIR OF DEFECTIVE PARTS AT OUR DISCRETION. WE HAVE NO LIABILITY FOR ANY SPECIAL OR CONSEQUENTIAL DAMAGES, HOWEVER CAUSED. THERE ARE NO OTHER WARRANTIES EXCEPT AS SET FORTH ABOVE.

CUSTOMER'S COPY



P.O. BOX 310, QUAKER RD., GLENS FALLS, N.Y. 12801/TEL. 518-793-8801/TELEX 145339

Page Two

Quotation Number: Q82-041T

MANUALS:

Two operating manuals supplied with purchase of this equipment. Additional manuals \$15 each. Reproducibles of drawings (sepias or microfile aperture cards)

available at \$5 each.

START-UP

SERVICE : For the AES Products as outlined in this quotation, no

charge service will be provided as follows:

Field Service Technician: Two Days Applications Engineer : Two Days

The customer has the option of assigning this no charge service time for Training Sessions, Installation Inspection or Start-Up Assistance. Should additional service be required, the following rates apply:

> Field Service Technician @ \$220 per day Applications Engineer @ \$350 per day

When service is scheduled by the customer with less than one week's notice, travel expenses will be charged A Purchase Order must be issued to cover the additional service requirements beyond the allocation as stated above.

VALIDITY:

The prices quoted are firm for order placement 60 days from the date of this quotation for delivery not to exceed six (6) months from date of order issuance.

WARRANTY: ALBANY ENGINEERED SYSTEMS WARRANTS ALL AES PRODUCTS AGAINST DEFECTS IN MATERIALS AND WORKMANSHIP IN NORMAL USE FOR ONE YEAR FROM DATE OF SHIPMENT, SUCH WARRANTY BEING LIMITED TO REPLACEMENT OR REPAIR OF DEFECTIVE PARTS AT OUR DISCRETION. WE HAVE NO LIABILITY FOR ANY SPECIAL OR CONSEQUENTIAL DAMAGES, HOWEVER CAUSED. THERE ARE NO OTHER WARRANTIES EXCEPT AS SET FORTH ABOVE.

QUOTATION



P.O. BOX 310, QUAKER RD., GLENS FALLS, N.Y. 12801/TEL, 518-793-8801/TELEX 145339

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|----|----|---|----------|---|---|---|---|
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| - | | _ | _ | | _ | _ | _ |

Quotation Number: Q82-041T

SHIPMENT: After receipt of order and full customer approved

technical data enabling us to proceed with engineering and manufacturing, our delivery schedule for the equipment specified in this quotation is detailed below. Any delay in our receipt of customer approved technical

data may adversely affect the delivery date.

FOB: Denver, Co - 12-14 weeks

TERMS : 25% with prints for customer approval - Net 30 days.

75% at shipment - Net 30 days.

ACCEPTANCE: Orders are subject to acceptance at Glens Falls, NY.

| ву: | Peg | Campl | oell | _ |
|-----|-----|-------|---------|---|
| | Cus | tomer | Service | |

WARRANTY: ALBANY ENGINEERED SYSTEMS WARRANTS ALL AES PRODUCTS AGAINST DEFECTS IN MATERIALS AND WORKMANSHIP IN NORMAL USE FOR ONE YEAR FROM DATE OF SHIPMENT, SUCH WARRANTY BEING LIMITED TO REPLACEMENT OR REPAIR OF DEFECTIVE PARTS AT OUR DISCRETION. WE HAVE NO LIABILITY FOR ANY SPECIAL OR CONSEQUENTIAL DAMAGES, HOWEVER CAUSED. THERE ARE NO OTHER WARRANTIES EXCEPT AS SET FORTH ABOVE.

PROPOSAL

P.O. Box 6753 Phoenix, Arizona 85005-6573 (602) 269-1323



XX P.O. Box 27024 Tucson, Arizona 85726-7024 (602 792-3255

FORMERLY AIR COMPRESSOR SERVICE

TO:

Rubel and Hager, Inc.

DATE July 8, 1982

This proposal effective for 30 Days.

Attn: Mr. Frederick Rubel, Jr., P.E.

| QUAN. DESCRIPTION UNIT PRICE AMOUNT INGERSOLL-RAND COMPRESSOR PACKAGE, MODEL 7E3, COMPLETE WITH THE FOLLOWING MAJOR COMPONENTS: a) BARE COMPRESSOR #253 b) 7½ H.P. NEMA 3 PHASE 230/460 V MOTOR c) 120 GAL. ASME RECEIVER TANK d) PRE-WIRED AND MOUNTED MAGNETIC STARTER e) AIR COOLED INTERCOOLER f) ENCLOSED BELT GUARD g) AUTO/START/STOP CONTROL h) SAFETY SERVICE AND DRAIN VALVE. PERFORMANCE DATA a) 26.2 CFM PISTON DISPLACEMENT b) 20.3 CFM @ 100 PSI c) COMPRESSOR RPM - 660. |
|--|
| WITH THE FOLLOWING MAJOR COMPONENTS: a) BARE COMPRESSOR #253 b) 7½ H.P. NEMA 3 PHASE 230/460 V MOTOR c) 120 GAL. ASME RECEIVER TANK d) PRE-WIRED AND MOUNTED MAGNETIC STARTER e) AIR COOLED INTERCOOLER f) ENCLOSED BELT GUARD g) AUTO/START/STOP CONTROL h) SAFETY SERVICE AND DRAIN VALVE. PERFORMANCE DATA a) 26.2 CFM PISTON DISPLACEMENT b) 20.3 CFM @ 100 PSI |
| a) BARE COMPRESSOR #253 b) 7½ H.P. NEMA 3 PHASE 230/460 V MOTOR c) 120 GAL. ASME RECEIVER TANK d) PRE-WIRED AND MOUNTED MAGNETIC STARTER e) AIR COOLED INTERCOOLER f) ENCLOSED BELT GUARD g) AUTO/START/STOP CONTROL h) SAFETY SERVICE AND DRAIN VALVE. PERFORMANCE DATA a) 26.2 CFM PISTON DISPLACEMENT b) 20.3 CFM @ 100 PSI |
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| a) 26.2 CFM PISTON DISPLACEMENT b) 20.3 CFM @ 100 PSI |
| b) 20.3 CFM @ 100 PSI |
| 6, 65, 65, 65, 65, 65, 65, 65, 65, 65, 6 |
| TOTAL NET PRICE |
| All Applicable Taxes to Apply Prices quoted are subject to adjustment to price in effect at time of shi |

ment.

| F.O.B | Delivered Job Site | |
|------------|--------------------|--|
| Delivery . | One week | |
| Tanna | Net 30 days | |

or as otherwise stated herein. All items quoted herein are subject to prior sale or other disposition.

All orders taken which require financing are subject to the approval of our credit department or that of the financing institution.

Warranty is limited to that on new machines as furnished by Manufacturers

Delivery date given on this order is contingent upon promised shipment from our suppliers and upon government restrictions or other factors beyond our

The above proposal is hereby accepted as outlined:

| | Y | 1.1.11 | |
|----|------|--------|--|
| BY | Dick | capil | |

PIONEER EQUIPMENT, INC.

This quotation not valid unless signed

| Customer | |
|----------|--|
| RY | |

Northwest Boundary Containment Treatment Facility Rocky Mountain Arsenal, Commerce City, Colorado Stearns-Roger Subcontract No. 7000 C26616

Process Design Calculations

Prepared by: D. G. Hager Checked by: F. Rubel, Jr.

I. Sizing of Liquid Phase Adsorption Vessels

A. Design Criteria

- 1) Superficial residence (empty bed) time required in upflow packed granular activated carbon bed for removal of 0.8 µg/l excess DBCP from potable water 15 minutes minimum.
- 2) Raw water flow rate 1500 gpm maximum.
- 3) Standard Westvaco Pulse Bed Adsorber volume 1400 ft.3.

B. Calculations

- - b. Try three (3) standard Pulse Bed Adsorbers Volume = 3 x 1400 ft³ = 4200 ft³ = 31,500 gallons
 Superficial Residence Time = 31,500 gallons =
 1500 gpm
 21 minutes > 15 minutes... OK
 Use Three (3) standard Pulse Bed Adsorbers

2) Flow rate per adsorber

1500 gpm = 500 gpm/adsorber
3 adsorbers

II. Process Pipe Sizing

A. Design Criteria

- 1) Pipe material schedule 80 Type I PVC
- 2) Flow rate per treatment branch (train) = <500 gpm
- Raw water velocity ≤8.0 ft/sec
- 4) Treated water velocity ≤5.0 ft/sec
- 5) Slurry Flush/Eductor/Backwash water velocity ≤8.0 ft/sec

B. Calculations

- Raw water pipe size (identical piping for each train)
 - a) Try 4", v = 8.99 ft/sec >8.0 ft/sec ... NG
 - b) Try 6", v = 6.27 ft/sec <8.0 ft/sec : OK

Use 6" Schedule 80 Type I PVC Pipe and Fittings for Raw Water.

- 2) Treated water pipe size Effluent from one adsorber
 - a) Try 6", v = 6.27 ft/sec >5.0 ft/sec :. NG
 - b) Try 8", v = 3.57 ft/sec <5.0 ft/sec .. OK

Use 8" Schedule 80 Type I PVC Pipe and Fittings for Effluent from one Adsorber.

- 3) Treated water pipe size Effluent from two adsorbers
 - a) Try 8", v = 7.14 ft/sec >5.0 ft/sec .. NG
 - b) Try 10", v = 4.54 ft/sec <5.0 ft/sec .. OK

Use 10" Schedule 80 Type I PVC Pipe and Fittings for Effluent from two Adsorbers.

- 4) Treated water pipe size Effluent from three adsorbers
 - a) Try 10", v = 6.80 ft/sec >5.0 ft/sec .. NG
 - b) Try 12", v = 4.81 ft/sec <5.0 ft/sec .. OK

Use 12" Schedule 80 Type I PVC Pipe and Fittings for Effluent from three Adsorbers.

- 5) Slurry Flush/Eductor/Backwash water pipe size
 - a) Try 3", v = 8.72 ft/sec >8.0 ft/sec : NG
 - b) Try 4", v = 5.02 ft/sec <5.0 ft/sec .. OK

Use 4" Schedule 80 Type I PVC Pipe and Fittings for Slurry Flush/Eductor/Backwash Water System.

III. Carbon Slurry Transfer Pipe Sizing

A. Criteria

- Carbon Slurry Transfer to and from Carbon Transport Trailer - 4" Polypropylene lined Carbon Steel (flanged) Pipe
- 2. Carbon Slurry Tansfer to and from Carbon Blowcases - 2" Polypropylene lined Carbon Steel (flanged) Pipe
- 3. Carbon Slurry Velocity = 5 ft/sec
- 4. Dry carbon density = 30 lb/ft3

B. Calculations

1. Time to transfer 20,000 lbs. granular activated carbon truckload to or from Carbon Transport Trailer

Pipe inside diameter = 3.612 in., Area = 10.25 in.² = .0712 ft² @ velocity = 5 ft/sec Volume = 0.3558 ft³/sec = 21.35 ft³/min = 640 lb/min Transfer Time = $\frac{20,000 \text{ lbs.}}{640 \text{ lbs/min}}$ = $\frac{31.3 \text{ minutes}}{640 \text{ min}}$

2. Time to transfer 2,000 lb. granular activated Carbon Pulse to and from Carbon Blowcases

Pipe inside diameter = 1.723 in., Area = 2.35 in.² = .0164 ft² @ velocity = 5 ft/sec Volume = 0.0818 ft³/sec = 4.91 ft³/min = 147 lbs/min Transfer Time = $\frac{2,000 \text{ lbs.}}{147 \text{ lbs/min}}$ = $\frac{13.6 \text{ minutes}}{13.6 \text{ minutes}}$

IV. Process Water Pressure Drop through each Treatment Train

A. Criteria

- 1. Since the piping design has not been accomplished at this time, a pressure drop calculation based upon conservative assumptions is provided.
- 2. Flow rate 500 gpm through 6" and 8" Pipe; head loss per 100' is 0.87 and 0.22 psig respectively.
- 3. Flow rate 1500 gpm through 12" Pipe; head loss per 100' = 0.24 psig.

B. Calculations

1. Pressure Drop through Pipe and Fittings

| Equivalent | |
|---|----------|
| Pipe Length | ΔP |
| a) 80'-6" Sch. 80 PVC Pipe 80 | |
| b) 3 -6" Sch.80 PVC Tee @ 32.2' 96.6 | 2.3 |
| c) 6 -6" Sch.80 PVC 90° Ell @15.2' 91.2 | |
| d) 40'-8" Sch.80 PVC Pipe 40 | |
| 4/ .0 0 50.1100 | 0.4 |
| f) 4 -8" Sch.80 PVC 90° Ell @20' 80 | |
| g) 40'-12" Sch.80 PVC Pipe 40 | |
| h) 3 -12" Sch.80 PVC 80° Ell @ 30 90 | 0.3 |
| ii) 5 -12 Sch. 80 1 vc 80 222 c 30 30 } | |
| | 3.0 psig |
| | 0.0 F0-5 |

2. Pressure Drop Through Valves and Flow Controller

| b) | 3-6: | Check Valve @ 0.1 psig@ Butterfly Valves @ 0.3 psig@ Rate of Flow Controller @ 7.0 | 0.1 | |
|----|------|--|------|------|
| C) | T- | psig (max.) | 9.0 | |
| | | | 10.0 | psig |

3. Pressure Drop Through Adsorber and Filter Modules (pressure drop will build up in each of these modules until a maximum is reached at which time backwash or cartridge change will significantly decrease the pressure drop).

| | ΔΡ |
|--|-----------|
| a) Prefilter Module - 15 psi (max.)b) Pulse Bed Adsorber Module - | 15.0 |
| 25 psi (max.) | 25.0 |
| c) Post filter Module - 10 psi(max.) | 10.0 |
| | 50.0 psig |
| 4. Gravity head - 12 ft. | 5.2 psig |
| 5. Velocity head | 0.3 psig |
| 6. Total ΔP (1 through 5 above) | 68.5 psig |

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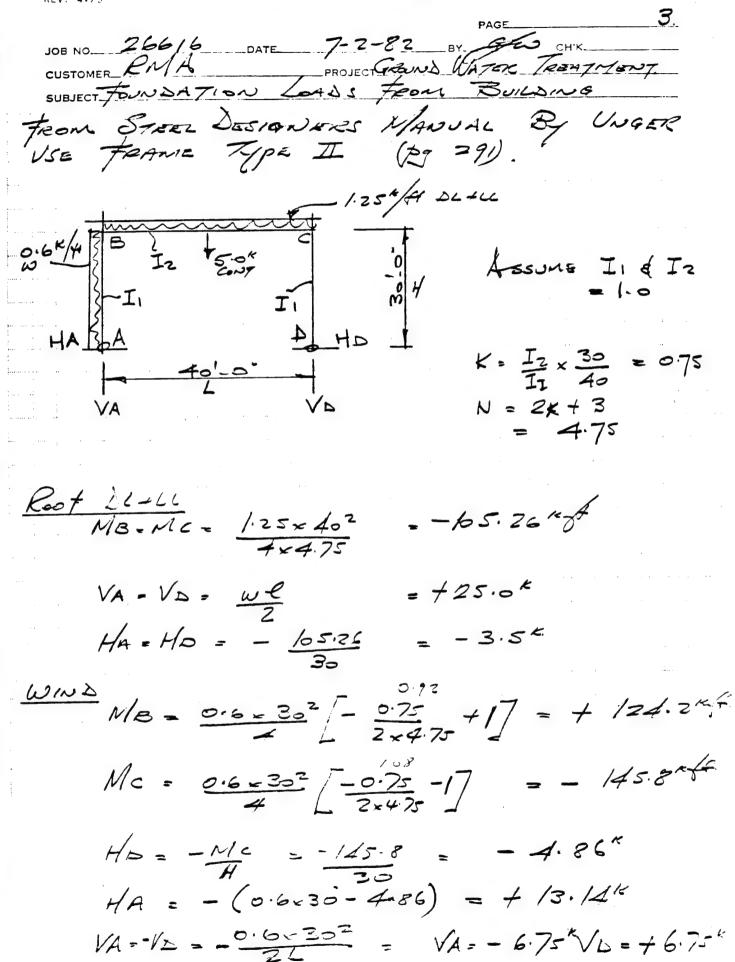
JOB NO 26616 DATE 7-2-82 BY GOO CH'K CUSTOMER R N A. PROJECT GROWN WATER TREATMENT.

SUBJECT DESIGN LOALS STRUCTURAL. BUILDING LOADS PRELIMINARY DESIGN.
ROOF DEAD LOAD - 20 pst LIVE LOAD OR? = 30 psf = (0.8 x 35 psf)

SNOW LOAD AT MED SPAN = SAY 5.0 K. WALL LOAD = 24 psf. Ansi Exposure C" WIND LOAD SEISMIC ZONE 1 3000 psf. SOIL BEARING PROSSURE EQUIPMENT LOADS Encul = 140,000 Ls. ADSORBERS DUAL BLOW CHSE: 20000 les Excel. STORAGE MODULE = 75,000 lbs POST FILTER
FUMPS Access WALKUAY BEAD LOAD = 25pif ALLOWANCE OF GROUT FOR LEVEL WITH ALLOWANCE OF GROUT FOR LEVELLING. FOUNDATION DEPTHS TO BELOW FROST LINE of 31-6: AEIM 9. 1/81.

JOB NO 26616 DATE 7-2-82 BY GOW CH'K CUSTOMER R.M.A. PROJECT GROUND WATER TREMTIMENT SUBJECT FOUNDATION LOKAS FROM BUILDING CENTER CONS. TRIBUTIFIEY WISTH 250" SPAN 40-0" HEIGHT 30'-0" 0.5 1/5/ Roof DL = 20 x 25-0" LL = 30 = 25'-0' 0.75 K/44 REACTION AT COL: 1.25-49/2 5-0" GNTINGENCY + 2.5% Roof TOTAL /COL = 27.5% LOAD FROM SING - 5×25×300 = TOTAL VERTICAL AT BASE END COLS WILL BE /2 THIS LOAS
PLUS VERTICAL END WALL LOAS = 31.25/2 + 5x14x30 WIND LOAD ON SIDE WARL | = 24x 25'0" = 0.6" A CENTER COL 0.3" H LUD COL By INSPECTION WIND WILL CONTROL BUILDING DOCTION AND SEISMIC WILL CONTROL FOUN ATIONS FOR INTERIOR VESSELS.

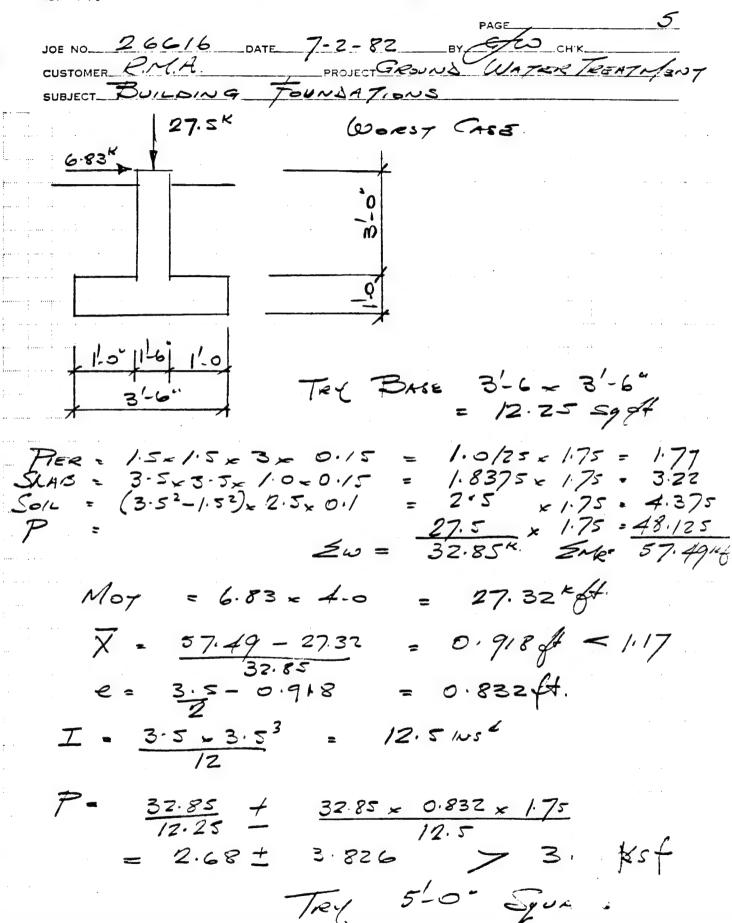
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| | PAGE |
|---|---------------------|
| JOE NO. 26616 DATE 7-2-82 | IND WATER TREATMENT |
| JOE NO. 26616 DATE 7-2-82 CUSTOMER RMA PROJECT GROW SUBJECT FOUNDATION LOADS FROM | n BuiLDING. |
| 5.0 K GNTINGENCY LOAL. | |
| MB = Mc = - 3-5-40 8x 4.75 | = -15.8 mgf |
| VA = VD = 5/2 | = 42.5 K |
| HA = HO = - 15.8 | =-0.53 |

TOTAL LOADS

| LOAD | ME | Mc | VA | VD | HA | 40 |
|-----------|---------|---------|---------|--------|----------------|---------|
| DL+LL | | -105.26 | / | +25.0 | | -3.5 |
| WIND | +124.2 | -148.8 | - 6.75 | + 6.75 | -4.86 | + 13.14 |
| 5.0K. | -15.8 | -15.8 | 4 2,5 | + 2·5 | <i>- 0</i> ⋅53 | -0.53 |
| DL+LL+5.0 | -/21.06 | -121.06 | + 27.5 | +27.5 | -4.03 | -4.03 |
| WITHWIND | | | | | | |
| AT 0.75 | 2.36 | 2004 | + 15.56 | +25.69 | -6.67K | +6.83K |



JOB NO. 266/6 DATE 7-2-82 BY GHIK CHIK CUSTOMER P. N.A. PROJECT GROUND WATER TREMTMENT SUBJECT BUILDING FOUNDATIONS PIER = 1.5x 1.5x 3x 0.15 = 1.0/25x 2.5 SLAN = 5.0 x 5.0 x 1.0 x 0.15 = 3.75 x 2.5 Soll = (5.02-1.52) x 3x011 = 6.825 x 2.5 = 27.5 × 2.5 Sw= 39.1K. SMR= Mo7 = 6.83-4 = 27.324 97.72-27.32 e: 5:0 - 1.8 = I - 5.0-5.03 = $7 = \frac{39.1}{25.0} + \frac{39.1 \times 0.7 \times 2.5}{52.08}$ = +2.878 kst < 3.0 = 1.564 ± 1.314 + 0. 22 xs+ + 1.75# FACE of FIER BN(@ FALE of PIER = 1.958 x 1.75 2 0.92 x 1.75 20.66 4.0 = 0.250 Min As. 12x12x0.002 - 0.2884 USE #5@ 12 CES BOTH WAYS IN SLAR.

SUBJECT BUILDING FOUNDATIONS PIER ROINFORCING. 20 49 × ft BM = 6.83 x 3:0 0.862 F As = 20.49 1.76 × 13.5 USE Z-#6 As=0.88" & Use 4 - # 6 in pieces with #3 Ties AT /2" Conjoes. CORNER COLS WILL HAVE /2 ROOF LOAD & /2 WIND LOAD. BUT WILL HAVE ADDITIONAL SISING LOAD. 6.83/2 = 3.42K So HORIZONTAL FROM WND = FROM Roof = 25.0/2

FROM Roof = 25.0/2

FROM CONTINGUNCY = 1.5% = 1.875* = 12.5 K 5-0 20-875×10-12 Vary SXY 21.0K TRY 3.6" Sy EASE (\$95) 1.0125 = 1.75 Tige : 1.5x1.5x3-0.15 1.8375 - 1.75 3.22 JUB: 3.5x3.5x/10x0.15 1.75 Sou = (3.52-1.52) x 2.5x0.1 = = 4.375 2.5 · 36.75 21.0 1.75 10 SM = 46.115' MoT = 3.42 x 4.0 = 13.68 x ft

JOB NO 26616 DATE 7-6-82 BY 9/60 CH'K.

CUSTOMER R. N. A PROJECT GRAND 11/4-70 SUBJECT BUILDING FOUNDA TIONS CORNER COLS (Cony). 1.2384 X = 46.11-13.68 26.38 0.5294 e. 3.5 - 1.23 I = /2.5 ms P= 26.38 + 26.38 × 0.52 × 1.75
12.25 - 12.5 2-15 £ 1.92 = 4-07 > 3.0 FOR PRELIMINARY DESIGN
USE 400 Sy SwiTH #50 /2" CAS
USE SAME FOR PIER 1-6" SQUARES
4-46 \$ # 37105. EQUIPMENT FOUNDATIONS WITH EQUIPMENT BEING INSIDE BUILDING SEISMIC WILL GNITROL DESIGN OF FOUNDATION ADSORBERS W= 140" ENCH, 91.0" \$,23.0" HIGH V-ZKCW - 0.25 x 2.0 x 0.1 x 140 = 7.0 K OTM = 7.0 = 11.5 = 80.5 Kgf ROSISITING MONIENT = 140x 4.5 = 630 M/F + BASE WRIGHT = 91.0x960 = 0.83x015 = 10.12x 45 - 455 MF

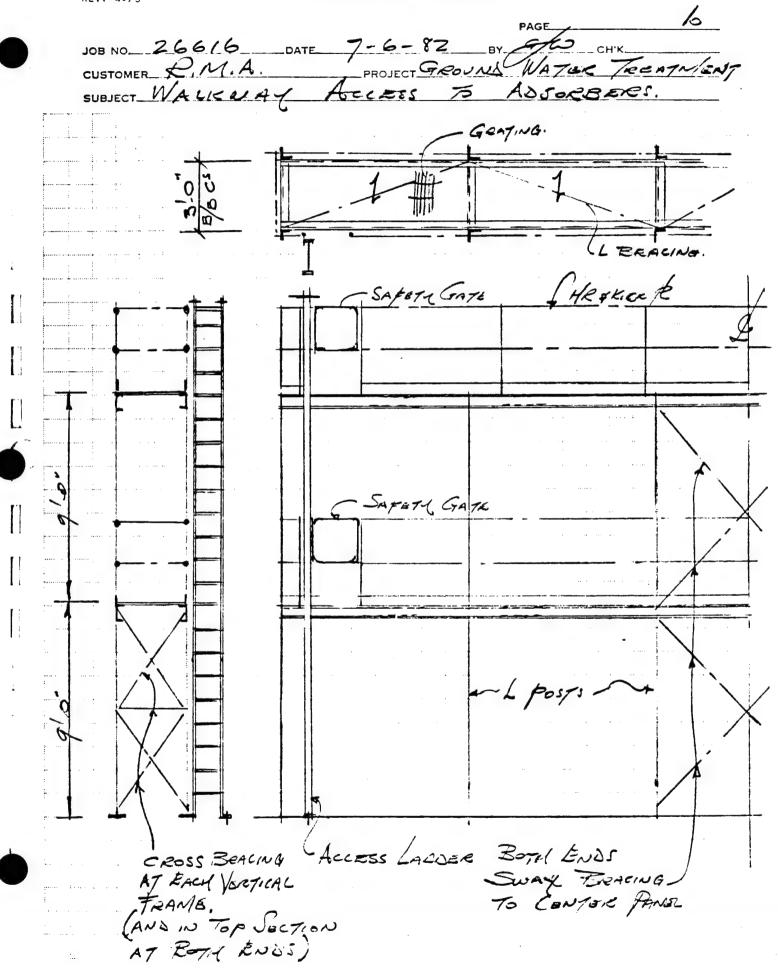
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FORM 62-114 REV. 4-75

CUSTOMER RMA PROJECTGROUND WATER TRUMINATIONS SUBJECT FOUNDATIONS. ADSORBERS (ONT). X = 675.5 - 80.5 3.96# e = 9.0 - 3.96 0.544. $I = 9.0 \times 9.0^3$ 546.75,ws4 P = 150./2 + 150.12 x 0.56 x 4.5 546.75 - 1.853 £ 0.667 + 2.52 ×5+ 1.186454 OK - 3-0 x37 Mino As = /2×/0×0.002 0.24 Sq 105 Mre # 10 9" CRS (AS = 0.27)
BOTH WHYS IN TOTTONI. By Inspacyion of ALL ROUIPMENT LOADS AND SIZE OF FOUNDATIONS, USE THE KROVE FOR ALL LARGE FOUNDATIONS USE 1-3 THICK SCAR + 2" GROUT ALLOWANCE TO KNOW FOR I'M ANCHOR BOT PULL OUT CAPACITY

EMBEDMENT LENGTH OF 12"

TOOR SLAR 6" THICK KEINFORCED WITH ONE LAYER WWT 4-4-W4.0=W4.0



| | | | | PAGE L | | |
|----------------|--------|---------------|--------------------|------------|----------|----------|
| 2/1/ | | 7-8-8 | 22 | ev TKO | CH'K | JMC |
| CUSTOMER ROCKY | 11)70/ | ARE ENTIRE DE | POJECT RA | W WATER TI | REATMENT | FALILITY |
| SUBJECT TOILET | Dema | | TOJECT <u>III.</u> | | | |
| SUBJECTIOILEI | REGIM | | | | | |

VENTILATION

SIZE OF ROOM 6'WX 8'LX 9'H - FROM ARCH.

MIN. VOUTILATION = 10 AC/AR. PER TMS-810-1 PG. ZZ

VOLUME OF ROOM= (6)(8)(9) = 432 FT3

:. MIN CFM = (432FT3) (10) (HR) = 7.2 CFM

COST OF FAN FROM MEHIO 1582 PG 226 => #63.00
IDSTALLATION = 1 M. H.

ZOFT DOCTWORK @ 166/FT > COST = #3.20 INSTALLATION > . OS M.H. /FT TOTAL = 1 M.H.

WALLGAILLE -> 6"x6" COST = 5.00 LABOR = 1M.H.

Stearns-Roger

| | | | PAGE _ | ۷ |
|---------|-------|-------------|--------|----------|
| JOE NO. | 26616 | DATE 7-8-82 | BY | CH'K JMC |
| CUSTOME | R | PROJECT | | |
| | Taker | | | |

HEATING

Two OUTSIDE WALLS > U= ,15 F.FIL

AREA WALL I B'WX8'H = 64FT2 WALL Z 6'WX8'H = 48FT2

TOTAL HREA = 112 FT2

DESIGN TEMP FROM TITS-810-1, PGI, TEMP= 60°F FROM TMS-785 WENTER DESIGN DRY-BULB > 97.5%: 10F

: ST= 60-1 = 59°F

ESTIMATE UVALUE OF INTERNAL WALLS & CEILING = ,30 ST. FILL FROM ASHRAE 1981 FUNDAMENTALS TAKE4C PG 23.21

AREA OF WALLS = 112 FT SAME AS EXTERIOR WALLS AREA OF CEILING = 8' + 6' = 48FT2

1. TOTAL AREA = 160FT2 ST= 60-40 = 20°F

:. Q=UA DT= (.3)(160)(200F) = 960 BTOH

.. TOTAL HEAT NEED= 960 + 990 : 1950 RTUH ~ 2000 BTUH ~ 600 W

FORM 62-114 REV. 4-75

Stearns-Roger

| | PAGE <u>3</u> | | |
|---|----------------------------|-------------|--|
| JOB NO DATE | | CH'K. JMC | |
| CUSTOMER | PROJECT | | |
| SUBJECT | | | |
| DESIGN USING INFRARED FOR A DAYTON SS TREE #47.00 | HEATING. DW GRANGER STO | xx = 541374 | |

USING A GENERAL ELECTRIC CH 500 T3 SOON INCAMBESCENT LIGHT WITH A RECECSED FINITIE. PRILE FIX.00. USE A THENMOSPIT = 40,00 TO BE ESTIMATED BY ELECTRICAL.

JOB NO. 26616 DATE 7-1-82 BY TICO CH'K JMC CUSTOMER ROCKY INTIO. AKSENGL PROJECT RAW WHITER TREATMENT FACILITY SUBJECT HEIRT LOAD CALC.

ASSUME U VALUES:

WALL= .15 F-FT2 } REF DOD. AZ70; 1-M TARLE9.Z

ROOF = .10 F-FT2

DESIGN INTERIOR TEMP= 400F , REF: NO 4270.1-M, CH. 9-2.1

CALL. OF HEAT LOAD.:

DEF.: ASHRAE FUNDAMENTALS 1981 - 25.2

Q=UA*TD

WINTER DEAGN DRT-BUR > 97.5% = 10 TM5-785 : TD=40-1=39°F

FROM ARCH. DOG. ROOF AREA = (40 FT) (73 FT) = 2920 FT2

WALL AREA = 30FT (2(40 FT) + 2(73 FT)) = 6780 FT2

Q=UA AT > Q WALL = (.15)(6780)(39) = 3970 CBTUH Q ROOF = (.10)(2920)(39) = 11400 PTUH 51100 BTUH

TOTAL HEAT LOAD FOR WINTER = 51160 BTOH DUE TO TRANSMISSION HEAT LOSS

| | | | PAGE | | |
|----------|------|---------|--------|----------|--|
| JOB NO. | DATE | | BY TRO | CH'K JHL | |
| CUSTOMER | | PROJECT | | | |
| SHRIECT | | | | | |

PER ASHRAE CH 22.8 ESTIMATE 1 AC./HR. DUE TO INFILTRATION

.. VOLUME OF AIR > (30)(40)(73) = 87600 FT³

.. Q = (1.08)(.825)(CFM)(AT)

=(1.08)(.825)(\$7600)(\$\frac{1}{2}}(40-1)

= 50 800 BTUH

.. HEAT LOAD DUE TO INFILTRATION = 50800 BTOH

HEAT LOAD THRO SLAB => ASHRAE 1981 FONDAMENTHUS => 25.8 > 25.9

Q = F2 P (Ti-To)

EST. FOR A METAL STUD WALL WITH INSULATION FZ= .53
P= PERIMETER OF PLAC = (2X40')+ 2(73)=226 FT

.: Q=(.53)(226)(40-1) = 4670BTUH

.. HEAT LOAD DE TO FLOOR SLAB = 4670

.. TOTAL DESEN HEAT LOAD = 51100 50800 4670 104570 BTUH

ADD 15% SAFETY FACTOR > (1.15) (106570) BTUH = 122560 BTUH

| | | | | PAGE J | | | |
|----------|--------|----------|----|--------|------|-----|---|
| JC B NO | DATE | | BY | TKO | CH'K | JMC | |
| JC 8 NO. | - 07/1 | | | | 0 | | _ |
| CUSTOMER | | _PROJECT | | | | | _ |
| CURIFOT | | | | | | | |

HEATING LOAD = 122,560 BTUH

USE 4 MODINE PA-50 HEATERS
RATED INPUT 50,000 BTUH
OUTPUT: 40,000 BTUH

DERATED. INAUT. (.84)(50,000) = 47,000 BRUH ONTAUT: (.84)(40,000) = 33,600 BRUH

TOTAL CAPACITY: INPUT: (4)(47,000)= KB,000 BOH
OUTPUT: (4)(33,600)= 134,400 BUH

HEAT THROW (FZ):23

PROPANE: 20 CFh EA. OR 80 CFh TOTAL

COST FOR UNIT HEATTER: \$ 480.00 EA WITH INTERMITTENT PLOT

LAKOR. 161. H. TOTAL

COST FOR 5 DIA. VENT CHIMINEY: 5" DIA > 100 FT

MATERIAL: \$2.50 L.F = \$250.00

LAKCR: 25 M.H. .25114/L.F.

THERMOSTATS B-C TA-121 MATERIAL \$ 55 EA.

PIPUS. 3/4" - 200' TOTAL PIPING

50' UNDERGROUND > 16 M.H. + TRENCHER

150' HUNG > 24 M.H.

MATERIAL # 1.00 LF = #200 FITTINGS = #200

JOB NO. 26616 DATE 7-7-87 BY TKO SHIK JMC CUSTOMER ROLKY BITN ARKENAL PROJECT RAW WATER TREATMENT FACILITY SUBJECT CARC. OF PROPER USAGE

REF. HEAT LOAD (ALCULATIONS.

: QWALL = (.15) (6780 / AT) = (017) (AT)

QROOF = (.10) (2920) (AT) = (292) (AT)

QTRANSMISSION = (1017+292) (AT) = (1309) AT)

QINFILTRATION = (1.08) (.825) (87600) (.60) (AT)

= (1301) (AT)

QSLAG = (.53) (226) (AT) = (120) (AT)

: QTOTAL = (1.15) (1309+1301+120) (AT)

= (3140) (AT)

REF. ASHPAE SYSTEMS 43.12 FOR DENLER AREA

| CUTLOOR | | BTUH @ | AT L | BTOH | TOTAL |
|---------|-------------|--------|------|-----------|------------|
| TENIP | HRS | 105 | 409F | HEAT LOSS | BTU |
| 37 | 717 | 3140 | 3 | 9420 | 6754140 |
| 32 | 721 | | 8 | 25 120 | 18 11 1520 |
| 27 | <i>5</i> 53 | | 13 | 40820 | 22 573 460 |
| 22 | 359 | | 18 | 56520 | 20290680 |
| 17 | 216 | | 23 | 72220 | 15 599 520 |
| 12 | 119 | | 28 | 81920 | 10 462 480 |
| 7 | 78 | | 33 | 103620 | E082360 |
| 2 | 36 | | · 38 | 119320 | 4295520 |
| -3 | 22 | | 43 | 135020 | 2 9 70 440 |
| -8 | 6 | | 48 | 150720 | 904320 |
| -13 | 1 | , | 53 | 166420 | 166420 |
| -18 | 1 | 1 | 58 | 182120 | 182120 |

TOTAL

11 0 392 980 RTU

ASSUME 80% EFFICIENCY ON HEATERS - 110392980 = 137,911,230 1570
,80

92000 BTU => GAL PROPANE: 157911230 = 1500 GAL
GAL. PROPANE
92000

... DESIGN YEAKLY USE OF PROPANE = 1500 GAL

| | | | PAGE | | |
|---------|-------|-------------|--------|------|-----|
| JOB NO. | 26616 | DATE 7-7-82 | BY TKO | CH'K | JUC |
| | | | | | |
| CUSTOM | =R | PROJECT | | | |
| SUBJECT | | | | | |

.: SIZE FOR 1000 GAL PROPAIDE TANK TO BE FILED INDUSTRICT IN THE WINTER

COST OF TANK: \$1500.00
REGULATING VALVE \$50.00

MUST INSTALL TANK 25FT MIN FROM BLOG.
INSTALLATION: 16 MI.H.

HANGERS FOR THE HEATERS > \$20.00 FOR EA HEATER

ISOLATION VALVES FOR HEATERS AND REGULATOR, 1. 10 VALVES 4000 EA.

VENT CAP @ \$20 EA .. \$80.00

| | | | PAGE | | | |
|----------|------|---------|--------|------|-----|---|
| JOB NO | DATE | | BY TKO | CH'K | JMC | |
| 308 NO. | | | | | | |
| CUSTOMER | | PROJECT | | | | _ |
| SHRIECT | | | | | | |

| LJH-I | OH-S | |
|--|------|--|
| No service of the ser | 7 | |
| | | |
| BLOK | | |
| | | |
| | | |
| | | |
| A 4 | | |

JUH-3

UH-4[

1000 1000

JOB NO. 2666 DATE 7-7-82 BY TKO CHIK JMC CUSTOMER ROCKY MTN. AKSENAL PROJECT RAW WATER TEXATMENT FAC.

SUBJECT COOLING LOAD

ASHRAC FUND. 1981 PG.ZG.3 Q=U*A*CLTD

COOLING LOAD DUE TO BOOF

V= .10 = FH= DOD 4270.1-M TABLE 9.2

A = (40')(75') = 3000FT²

CLTD = ASHRAE, FUND., PG. 26.8

TABLE SA CLTD = 79°F @ 14:00

PB. 26.8 CLTDCORR = [(CLTO+LN)K + (78-TR)+(5-85)] * 9

WHERE TROOM = 102°F EQUIPMENT MAX. TEMP.

TOUTSINE = 91°F 97.5% SUMMER DRY BULIS TAIS-785

f = 1.0 No ATTIC

LM=2 FROM TAIBLE 9A

K= 1.0 INDUSTRIAL AREA

.: CLTDCORR (79+2)+(78-102)+(9+85)

= 63°F

:. Qeof = (, 10) (3000) (63) = 18900 BTUH

COCUNG LOAD DUE TO WALLS

U=. 15 FFT DOD 4270.1-IN TABLE 9.7

AREAS OF WALL - NORTH AREA = AN = (40')(30') = 1200FT
SOUTH AREA = AS = (40')(30') = 1200FT
EAST AREA = AE = (75')(30') = 2250 FT
WEST AREA = AW = (75')(30') = 2250 FT -

FROM TARLEG GROUPB WALL

:. FROM TABLE 7A: NORTH WALL @ 2:00 CLTDN = 9°F

SOUTH WALL @ 2:00 CLTDs = 12°F

EAST WALL @ 2:00 CLTDN = 14°F

PG 26, 12 & CLTD CORR. (CLTD+LM) × K+ (78-TR)+ (TO-85)
SAME DESIGN CONDITIONS AS ABOVE

JOB NO. 26616 DATE 7-7-82 BY TKO CH'K JMC

CUSTOMER ______ PROJECT______

SUBJECT_

CLTOCORN = (9+1)(1.0)+(78-102)+(91-85) = -84

CLTD coxes = (12-1)+(78-102)+(91-85) =-79F

CLTUCORE = (72+1) + (78-102)+(91-85)

CLIDORRN = (A+1) + (18-102)+ (91-85) = -20F

... QNORTH WALL = (.15)(1200)(-8) = - 1440BTUH = QNW QSOUTH WALL = (.15)(1200)(-7) = - 12 00 BTUH = DSW QEAST WALL = (.15)(2250)(-5) = 1690BTUH = QEN QUEST WALL = (.15)(2250)(-3) = -1010BTUH = QWW

:. TOTAL Q FREM WALLS > QN = QNN + QSN + QEN + QNN = -1440-1260+1690-1010
QN = -2020BTUH

:. TOTAL TRANSMISSION GAIN = GROOF + QWALL = 18 900 + (-2020) :. QT = 15/80 ETUH

ESTIMATE LIGHT LONG = 1 W/FT2

(USE INCANDESCENT LIGHTS

HAEA = (40')(75') = 3000FT2

QL = (1"/FT2)(3000FT2)(3.4 ETCH)

QL = 10200 ETUH

| | | | | PAGE <u>3/4</u> | | |
|---------|-------|------|---------|-----------------|------|-----|
| JCB NO. | 26616 | DATE | 7.7-82 | BY TKO | CH'K | JMC |
| CUSTOME | | | PROJECT | | | |
| CUBICCE | | | | | | |

ESTIMATE EQUIPITENT, PUMP & AIR CONPRESSER MOTOR LOADS
TO BE 20 H.P. TOTAL. FROM ASHKAE 1961 FUNDAMENTALS
TABLE 24 PG. 26.29 MOTOR IN, DRIVEN EQUIPMENT OUT OF THE
AIR STREAM:

Qm=7610 BTOH

PERSONNIEL LOAD
FROM ASHRAE 1981 FUND., TABLE 18, PG.ZG.ZS LIGHT BENCH
WORK, MALE

QP=880 BTUH

I. TETAL DESIGN HEAT LOAD IN THE BLAS.

15180 BTUH - TRANSMISSION

10200 BTUH - LIGHTING

7610 BTUH - MICTORS

PRO BTUH - PERSONNEL

QUETAL = 33870 PETCH

ADD 20% SAFETY FACTOR :. Q TOTAL = (1.2 X 33570) . 40650 BTUH

DEUGN FOR A ROOM TEMP. = 102°F COTSIDE AIRTEMIP. = 910F .: AT= 11°F

: AMOUNT OF VENTILATION AIR > 40650 (1.08 X.825)(AT) = 40650 (1.08 X.825)(AT)

CFIN= 4150

| | | | PAGE TIT | |
|----------|-------|-------------|----------|-----------|
| JOB NO. | 26616 | DATE 7-7-82 | BY TKO | CHIK. JMC |
| | | | | |
| CUSTOMER | | PROJECT | | |
| CLIBIECT | | | | |

ACCORDING TO TM5-810-1 PG. 20 DESIGN USING GRAVITY AIR MOVERS WITH MANUAL SHUT OFF DAMPERS BASED ON A WIND VELOCITY OF 4111PH.

DESIGN FOR A STACK HEIGHT OF 30 FT AND A TEMP. DIFF. OF 100F.

- .. DESIGN USING A PENN AX-AIR RIDGE GRAVITY ROOF VENTILATOR AT DESIGN CONDITIONS \$ 359 CFM OPENING FT2
- : OPEN AREA NEEDED 4150CFM = 11.6FT359CFM/FRZ

FROM PERFORMANCE TAKE A 12TOX 10FT LONG UNIT HAS A CAPACITY OF 2620 CFM. THEREFIXE 2 UNITS ARE NEEDED.

COST OF EACH UNIT IS \$40000.

DESIGNED ARCOND ARMOD. INFORMATION ON UNITS ARE NOT GIVEN. SINCE LOUVERS ARE NOT INSTALLED FOR MAKE-UP AIR AND THE EFFICIENCY OF ARMICO GRAVITY AIR MOVERS IS UNKNOWN SEE FOR THREE UNITS AT 12 IN. WIDE X 10 FT LONG.

JOB NO. C-26616 DATE 7-8-82 WEW CHR

CUSTOMER COE - RMA N.W. BOUNDARY CONTAIN/TREAT. SYS

SUBJECT CONCEPT LIGHTING CALC. - BLDG. INTERIOR

BLDG. INTERIOR DIMENSIONS (APPROX)

75 FT x 39 FT x 29 FT HIGH

FIXTURE TYPE: PRISMATIC GLASS REFLECTOR

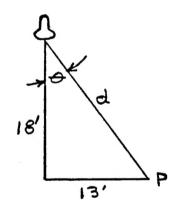
MFR.: HOLOPHANE

CAT. NO.: 1938

LAMP : 150 W HPS

MTG. HT.: 18 FT

FOOT CANDLE CALCULATION AT 13 FT FROM
O (NADIR)



$$TAN = \frac{13}{18}, = 35.84^{\circ}$$

 $d = \sqrt{13^2 + 18^2} = 22.2'$

T ≈ 5300 (FROM PHOTOMETRIC TEST DATA)

$$E = \frac{I}{d^2} \cos \Theta$$

 $= \frac{5300}{(22.2)^2} \cos 35.84^\circ = \frac{8.7 FC}{AT}$

USE 6 FIXTURES (2 ROWS OF 3 EACH)

THE CONTRIBUTION OF ILLUMINATION FROM
6 LTG.UNITS WILL INCREASE THE AVERAGE
1LLUMINATION TO AN ESTIMATED 20 FC AT
THE WORK PLANE.